P78-0721.(01)-.(06)

Vol. 34 (15 Ap 1921) }
35 (15 Ap 1922) } E3.5
36 (15 Ap 1923) }
37 (15 Ap 1924) }
Vol. 38 (15 Ap 1925) }
39 (Ap 1926) } E3.6

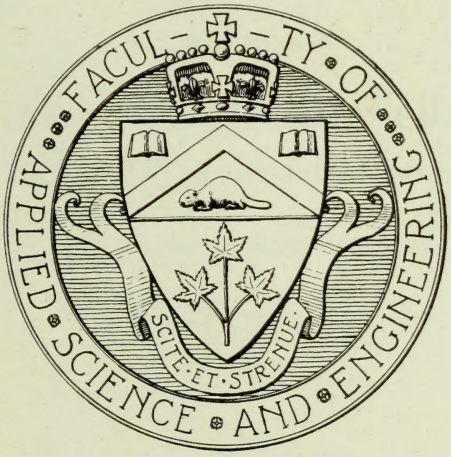
No. 36 1922-23

# The Transactions

of the

# University of Toronto Engineering Society

With which is incorporated the **Applied Science**




PUBLISHED BY THE SOCIETY

To

The Largest Class

that ever passed through

"The School of Science"

and to

Dean C. H. Mitchell

Honorary President of that Class

This Volume is Affectionately

Dedicated

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# *Foreword*

## ADDRESS OF THE RETIRING PRESIDENT

The publication of this book marks the close of the activities of the Engineering Society for another year. A review of them is unnecessary, for it is my hope that the entire book is exactly that.

On looking back over the year's work and the results of that work, one is struck with the conviction that the Engineering Society has grown to fulfil to a great degree the non-academic requirements of the students of this Faculty. To accomplish that completely will, I hope, be the motive directing the policies of future executives.

Centralization in the Engineering Society of all the activities of "School" men, has now been practically reached. Undoubtedly, this centralization is necessary for sound financial support and a successful business administration. However, this centralization should not be carried to an extreme in which the various organizations are hampered in developing along individual lines. Rather the reverse should be held and the existing organizations should be given a free hand to develop themselves, with constant observation by the Executive of the Society to detect lagging efforts or radical missteps. In this case, the Society should step in and give moral, financial and publicity support towards a rejuvenation of that organization's work. In this way only can the whole system be kept running at maximum efficiency.

The Executive of the Society should keep in view those general policies with respect to the non-academic needs of its members, and function towards their fulfillment.

Firstly, the be-all and end-all of its existence should be to foster and develop that tribal loyalty among its members which has come to be known as "School" spirit. School men have attained a high reputation for the sincerity of that "spirit" here in the University and outside. Not only should this tribal spirit be fostered because its reality alone makes possible the success of the multitudinous activities of the Society, but because it is a splendid thing to develop in young men. A capacity for loyalty and unselfish co-operation is an inestimable quality in the make up of any man, and a great factor towards his success and towards holding the respect of his fellows.

Secondly, the Society should endeavour to provide means for its members to become well acquainted. Undoubtedly one of the most valuable results of University education is the friends and acquaintances made. They not only make pleasant our four years stay here, but prove to be a great boon and pleasure in life after graduation. The Society has all

the machinery to accomplish this end and every effort should be made to draw out the hermit and inculcate a spirit of wide and real friendship among its members.

Thirdly, the Society should stand firmly and whole heartedly behind the efforts of the School Athletic Association, for on its activity, to a great degree, depends the status of the "School" in the competitive life of the University.

Fourthly, the Supply Department should be a means of saving money to the students. It should be a convenience and a real assistance by supplying the most requisite and helpful materials for their school work. It should be the community centre around which the life of the school revolves.

Fifthly, the Society should be the means of promoting a good understanding between the faculty and the students, for by a good understanding and complete exchange of views alone, can confidence be retained on both sides and the best obtained from the course. This year the formation of a Liaison Committee, which meets monthly, a committee composed of members of the Faculty in conference with the four year presidents and the president of the Engineering Society, has been a great step in this direction, and it is hoped that it will continue and grow in activity and importance.

Sixthly, the Society should endeavour to add to the regular course of the school as much non-academic education as possible. This can be best accomplished by the clubs themselves obtaining addresses from practical men engaged in their particular branch of engineering, and a few general meetings of the Engineering Society addressed by the best speakers procurable on subjects of general engineering interest.

Lastly, the Society should take its place in University activities and assist to the full extent of its resources, for only by the co-operation of the major faculty organizations can the success of University functions be assured.

In conclusion, the future executives of the Society would be well advised to observe that the program of the Society has changed considerably from year to year, and that its success to a great extent depends on its elasticity, for times are changing and people and students change with them.

I wish to thank the Dean and the Faculty for their support and advice, the executive and all members of the Society for the remarkable way they have supported me this year, and especially thank those few good souls who have been most closely connected with the work and have so generously given their time and best efforts to the work of the Society.

To my successor, Bill Osbourne, a successful year and a merry one.

F. J. LYLE.

THE TRANSACTIONS of the
University of Toronto
Engineering Society

WITH WHICH IS INCORPORATED THE "APPLIED SCIENCE"

No. 36 TORONTO, APRIL 15, 1923 1922-23

# SOME LARGE ENGINEERING PROBLEMS AND THEIR SOLUTION*

By T. Kennard Thomson, S.P.S. '86.

There is probably no contractor in the country who has not had occasion to express his opinion of some young pile inspector in very strong language. For the old contractor knows that the pile has been driven as it ought to be driven in that location, while the young inspector insists that they are just at some thin crust and insists on the further pounding of the pile, when all of a sudden the pile drops six or eight feet. "There," exclaims the young man, "I told you, we have gone through the thin crust now, so keep on driving until you come to hard bottom." But what really happened is that the pile had simply been pounded to destruction. In the case of some oak piles driven at Columbus, Ohio, described in Engineering News, of January 14th, 1909, the engineer states that 38 per cent. of these oak piles were destroyed in the driving.

Wooden piles, concrete piles, open coffer dams, pneumatic caissons, all have their proper places, and should be used there. And as regards the pile, the engineer should know before he starts driving how far he should drive it, instead of judging by the amount of battering on top.

### Vacuum Method

In 1852 an ingenious gentleman by the name of Potts attempted to put some six-foot diameter cylinders down 25 feet or so by the vacuum method, for he figured that if he pumped all the air out of the cylinders the weight of the atmosphere would amount to some 30 tons, and would be sufficient to drive these cylinders to the required depth. But, unfortunately for the inventor, logs were encountered, so his method would not work. The reverse was then tried, which was called the "Plenum Pneumatic" method. It was the first attempt to use compressed air for foundation work in America.

*From an address before the Society.

### Caissons

The next case was at the Third Avenue Harlem River Bridge, New York City. In this case a French engineer was engaged at a very high "per diem" which he innocently thought would continue to the end of the job. But, unfortunately, after about one week the contractor, who thought he had learned all the Frenchman could tell him, laid him off. This bridge had all cylindrical caissons, each ten feet in diameter.

The next caisson job was the first big caisson work in America, used for the Eads Bridge, St. Louis, Mo., in 1869. It is a liberal education to read the history of that bridge, so I hope that you have it in your library. As you know, we now have many text books and formulas for designing bridges and caissons and so on, whereas Eads had to make his own formulas, design his own shapes, decide what kind of tension members to use, as eye-bars were practically unknown. So the bridge was really a marvelous achievement. He put his air lock down in the working chamber instead of putting it on top as we do now. He had an enormous amount of timber in his deck, 9 to 14 feet, compared with the 3 feet of the modern caisson. I have built many of these, but now we often leave out all the timber in using reinforced concrete.

### Caissons for Building

The first building ever put on caisson foundation was in New York for the Manhattan Life Building in 1893. Here they built a steel caisson and tried building the brick work directly on top of it, but they soon found that the friction of the earth opened up the mortar joints of the brick work.

The contractor for this job though he had an economical method of procedure by blowing out the New York quicksand with more or less water and allowing it to flow into the sewers. But, unfortunately, the city officials were mean enough to object to having the sewers plugged and compelled him to clear the rest of the material away, a much more expensive method.

A pneumatic caisson in the process of sinking carries a lock on top of the working shaft with a top horizontal door and a lower flap door. The top door being open, the bucket drops into the lock and the two halves of the door close around a cable, then the valve is opened which permits the compressed air to flow into the lock. As soon as the air pressure in the lock is the same as that in the caisson below, the bottom or flap door drops of its own weight, after which it is a simple matter to lower the bucket into the working chamber and to attach a cable to another bucket which can be removed while the other bucket is being filled.

The air pressure must be just sufficient to balance the water pressure. As a cubic foot of water weighs 62 1/2 pounds, the weight at the bottom of the cubic foot is 62 1/2 which, divided by 144, gives .434 pounds per square inch, or a little less than half pound for each vertical foot of depth. That means that if the water is ten feet deep the pressure would be 4.34 pounds per square inch. For one hundred feet deep it means 43.4 pounds per square inch.

### Deepest Caisson

The greatest pressure on record was for the Municipal Building in New York City, where we had a depth of 112 feet and a pressure of about 50 pounds. I have always noticed that the actual pressure in the air chamber was very close to the theoretical head, whether in the heart of the city or right in the river.

In the first caisson in the Municipal Building, the pressure being so much greater than the contractor had previously experienced, the air pipe broke, and although it was only fifteen minutes before the pipe had been mended and the air pressure put on again, it was found that in the fifteen minutes the working chamber had been filled with sand, the sand was 16 feet above the deck, and the water 42 feet up the shaft. By a streak of good luck, the workmen had started up the shaft when this accident occurred, and you may be sure that they climbed up that ladder as fast as they knew how. In spite of which the last man had his feet in the water until he got above the 42 feet from the bottom.

The cheapest method of all, where it can be used, is to have a 5-inch pipe with a flexible hose at the bottom, and an elbow at the top. By opening a valve in the working chamber the sand and gravel can be blown out through this pipe as fast as it can be shoveled up to the pipe. In this case the speed of the work depends more on the speed of adding the coffer dam and the weight above than on the excavation.

I have seen the windows of a tug two hundred feet away smashed by the pebbles blown out through this pipe, and it is necessary to use the hardest kind of material, generally manganese steel, for the elbow. I have seen a cast iron elbow two inches thick worn right through in an hour.

### Build Up of Caissons

If the caissons are not more than 25 or 30 feet high, it is generally advisable to place all the concrete to this height before starting to sink. This makes a quick and economical job, and often prevents material from crowding in around the sides, greatly increasing the friction. In New York City I have carefully estimated the friction, and find it to vary from 30 to 650 pounds per square foot of a superficial exposed area.

### Caisson Disease

No one should be allowed to enter a compressed air chamber without a thorough medical examination, and anyone with a bad cold or anything the matter with his heart or lungs should not attempt to enter. Much more attention is paid to this now than formerly.

The first sensation in the lock is plugging of the ears or nostrils, and if this is not relieved the ear drums or blood vessels in the forehead may be ruptured. As for the drums, one soon learns how to equalize the pressure on both sides of the drums either by swallowing, chewing or holding the nostrils and blowing so as to get the same pressure inside as outside of the drums.

### The Bends

The next trouble is usually called the "bends," named because the

first man who experienced that trouble doubled up with pain which seemed very funny to the onlookers but not to the victim.

The bends might be described as sharp twinges like rheumatism or worse, and are generally due to entering the air chamber too quickly, allowing the air to displace the blood. They are also to a lesser extent due to coming out too quickly, from working too hard, or from working too long in the working chamber. In many places the law now specifies the time to be taken in entering and leaving, a law which has greatly reduced the amount of caisson sickness.

It has always seemed to me that foul atmosphere has more to do with this disease than even higher pressure. For when we sunk the caisson in the Harlem River, our men were a good deal troubled with caisson disease when going through the foul river mud, but after passing through the clean clay below at a very much higher pressure, they experienced very little trouble.

I have had the bends twice—quite enough—once in the arms and once in the leg. The first time I obtained relief by electric shocks, which did not do me any good the second time, but I found (that was long before the day of hospital locks) that by going in slowly, not staying in long, and coming out slowly, I was a little better after each trip, so I kept it up until I was free from pain. Nowadays, however, we have well-equipped hospital locks in which the patient can be put and carefully watched while under recompression.

One superintendent in one of the tunnels had a bad case of the bends and was yelling for his doctor to hurry up and put him in the lock, until the doctor lost patience and told him that he would have to wait until he got a dead man out of the lock. This same superintendent once told me that, as he was going into the office, one of his men stopped him and he asked him to wait a minute or two. In a few minutes, however, the man who had just come out of the caisson was found dead. The post mortem did not disclose the cause of the death. So, as the superintendent said, we have a whole lot to learn.

### Caisson Paralysis

But far worse than the bends is paralysis, and after a person has been once paralyzed by compressed air, he has no business to try it again. I have seen many who thought they were immune, but sooner or later their very carelessness resulted in an exceptionally bad attack. When one sees a half-paralyzed watchman or lock tender on these jobs, it is quite evident what the cause of his trouble was. On rare occasions a man is killed outright in the caissons. Many caisson diseases are now cured by re-compression and de-compression in the hospital locks. These locks are required by law in many States.

### Launching, etc.

There are many ways of getting a caisson in position for sinking. Small caissons may be hauled to the site and lowered in position by derricks. The river caissons are sometimes built on shore and skidded into

the water. Occasionally skids are not made strong enough and break down. Carelessness is expensive.

### Pontoons

Another way is to build a caisson on a pontoon, which is nothing more than a flat-bottomed boat having a three-inch plank at the bottom and the sides, arranged with a five or six-foot space all around the caisson to permit the building and caulking.

These pontoons have one or more joints in the bottom and are so arranged that when the caisson has been built, perhaps 14 feet or more high, and is ready for sinking, the connecting bolts of the joints are taken out and sand or gravel for weight is placed in the working chamber near the centre of the pontoon. The water is then allowed to flow in until the caisson is floating, taking most of the weight off the pontoon. Then the two halves of the pontoon often shoot out from under the caisson in a few seconds, with the caisson floating like a boat.

A new superintendent who had watched over the launching without using his eyesight properly, tried to launch his first caisson, but let a small amount of water enter and freeze before putting in enough to sink the caisson and pontoon down together. The result was that it took him three weeks to get his caisson off the pontoon instead of a few minutes.

Sometimes tugs are used to pull the halves apart, sometimes blocks and tackle with struts operating near the centre of the pontoon.

### Building on the Site

Out in the Missouri River the water was too shallow to float a caisson and carried too much sediment to make it possible to keep a channel dredged, so in that case we built a platform from which we hung the caisson up by means of sixteen three-inch rods, and after the caisson was ready for sinking, a gang of Italians turned the nuts at the tops of these rods, letting the caisson down gradually.

This looks like a clumsy method but, as a matter of fact, it turned out to be satisfactory and economical in this case, the time required being from twelve to twenty-four hours per caisson.

As an illustration of the trials and tribulations of a contractor, the case of a caisson in the Missouri River is pertinent. This caisson got badly out of plumb, in spite of the efforts to pile the weight on one side while undermining the cutting edge on the other side. The water rose so high that all efforts had to be abandoned for the time being, and finally when the water lowered a little the sand hogs were again put into the air chamber and succeeded in righting the caisson. Up to this time the contractor did not know whether the caisson was a total loss or not.

### Niagara River Water Power

The possibilities of utilizing the Niagara Falls water power have, of course, been obvious ever since the Falls were first discovered. But until very recently it was thought by most that the power was so unlimited that there would never be any need of developing the full force for commercial purposes.

The Porter family for generations endeavored to utilize part of this power, in the first place by operating mills and discharging water at a slight distance below the top of the bluff as they had no machinery in those days for handling the full head.

About 1850 a foresighted pioneer, Horace H. Day, obtained rights for a hydraulic canal which he actually constructed, but, being in advance of his times, he lost a million dollars in the venture. Then, in 1870, when that shrewd Buffalo banker, Jacob Schoelkopf, bought this canal for $75,000, people laughed at him and intimated that the old man was in his dotage. Many of these scoffers, however, would be only too pleased if they had had the ability and foresight to buy that canal, now worth many millions. It gave Jacob's son and grandson an opportunity of developing the Niagara Falls water power on a large scale, which they still control.

Hon. Peter A. Porter, as Assemblyman and afterwards Congressman, introduced a bill for the first hydro-electric plant in Niagara in 1886. This resulted in the first hydro-electric power being delivered in 1895. Scoffers again declared that there would never be a use for 50,000 horse power whereas, now, single consumers take far greater amounts.

This first development was quickly followed by four others, until the five pioneer companies, who staked their money and courage on this untried venture, had developed some 650,000 horse power at a cost of $65,000,000 or $100 per horse power. Being hard-pressed, as is always the case with pioneers, they made some long-term contracts, and sold much of this power from $9 to $15 per horse power.

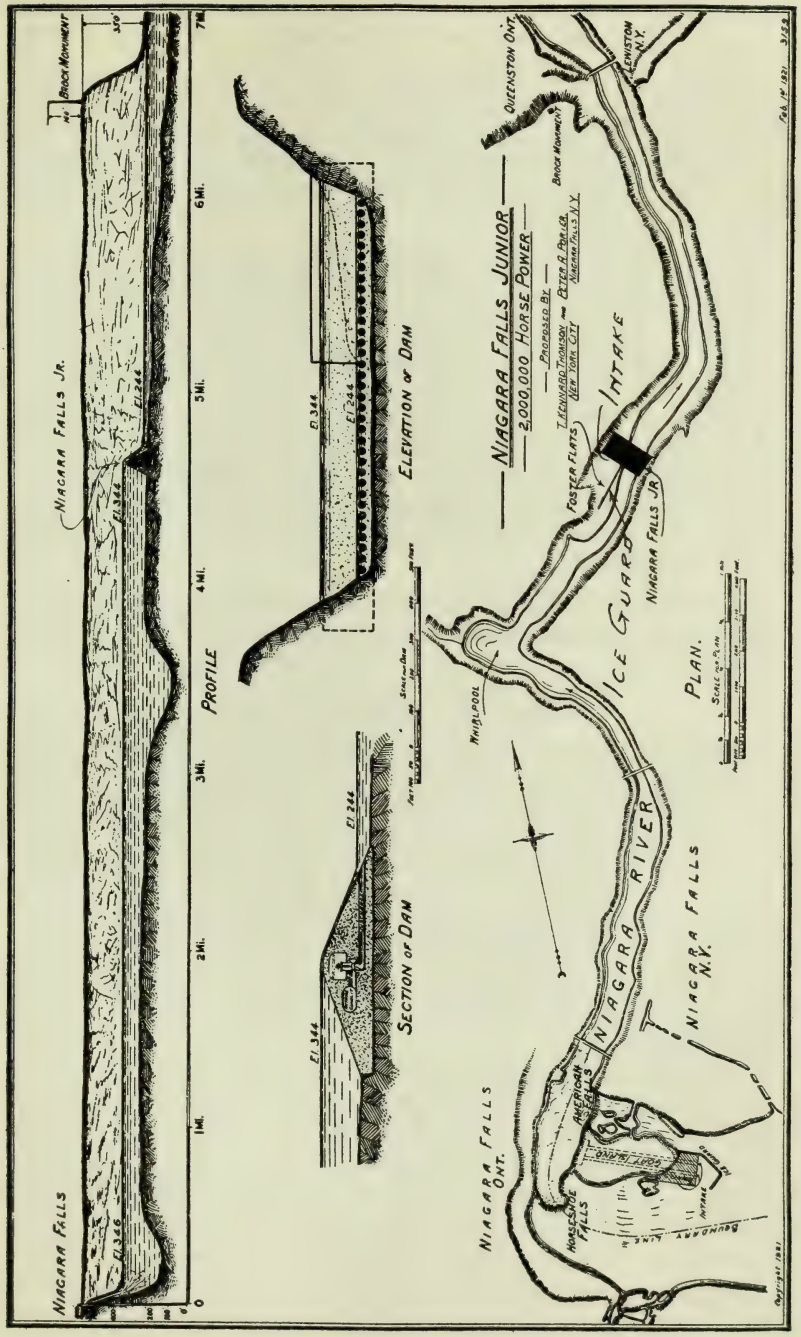
**Effect on Industry**

Incidentally, it may be remarked that the development of this water power had far-reaching results, probably never even contemplated by the promoters, and these results undoubtedly affect nearly every household in America without such households having the slightest suspicion of the fact. To take a single example, for instance, this cheap power made many things possible which were impossible before, such as cheap aluminum ware, the cost of which this power very greatly reduced, from $12 a pound to twenty cents a pound. So, surely, everyone who buys aluminum ware must now benefit by this great development, even if they do not know it.

This power also brought into existence, accidentally it is true, carborundum, which at first was sold for something like its actual value, but very quickly reduced in price to about the same extent as aluminum.

In addition to the $65,000,000 spent in the development of 650,000 horse power, the amount of investments in other industries, railroads, electric lights manufacturers and so on, resulting therefrom was $650,000,000, ten times the cost of the plants themselves.

In other words, the indirect value of hydro-electric power is easily ten, if not a hundred, times the direct value. For instance, the development of one hydro-electric horse power is supposed to make permanent work for one man. So if four million horse power were taken out of the Niagara River we would make permanent work for four million men. Utilizing


NIAGARA FALLS
NIAGARA FALLS JR.
BROCK MONUMENT
PROFILE
ELEVATION OF DAM
SECTION OF DAM
NIAGARA FALLS JUNIOR
2,000,000 HORSE POWER
PROPOSED BY
T. KENNARD THOMSON
NEW YORK CITY
PETER B. PORTER
NIAGARA FALLS, N.Y.
QUEENSTON ONT.
LEWISTON N.Y.
FOSTER FLATS
INTAKE
ICE GUARD
NIAGARA FALLS JR.
WHIRLPOOL
NIAGARA RIVER
NIAGARA FALLS ONT.
NIAGARA FALLS N.Y.
HORSESHOE FALLS
AMERICAN FALLS
GOAT ISLAND
BOUNDARY LINE
PLAN.

the whole minimum flow of the lower Niagara River and half the flow of the upper river, there would still be left one half the water to go over the Niagara Falls, after the development of four million horse power.

The next step of the development of the river was when the Hydro-Electric Power Commission of the Ontario Government, which had been buying power from the pioneer companies at from $9 to $15 a horse power, decided to obtain more power. It adopted the policy of taking advantage of the fall in the lower river as well as the upper river, and started the Chippawa-Queenston Canal.

The Chippawa-Queenston Canal is twelve and three-quarter miles long and loses about sixteen feet of the head, due to the grade required for a canal of this length and cross section. It was designed for only 16,000 cubic feet per second, whereas the minimum flow of the river is from 200,000 to 220,000 cubic feet per second. In the present international agreement, the Ontario Hydro is not allowed to take enough water from above the Falls to operate its own plants, plus the new plant, so in order to pass 16,000 cubic feet of water per second through the Chippawa-Queenston Canal it will be necessary for Hydro to put one of their old plants out of commission in order to get the extra power, unless a greater diversion is sanctioned.

But if there were no other way of obtaining this extra power, even such expenditure would be justified, as power would still cost a fraction of the cost by coal.

### Cost of Coal-generated Power

It might be mentioned here that when the first power project was being considered for Niagara, coal was being sold at $1.50 a ton, quite some difference from the present price, and when Mr. Stetson, the New York lawyer, was explaining the possibilities in London, they told him that it would never work because power generated by coal only cost one farthing per hour, a farthing, of course, being one-half cent. So Mr. Stetson at once figured out for them that one-half cent an hour amounted to $36 a year, and explained that he would be very glad to sell Niagara Falls power for $15 a horse power. As a matter of fact, he sold afterwards much at $9 to $15. Since that, the increased price of coal enormously increased the difference.

The cheapest power I know of developed by coal before the war was by New York Edison and New York Interborough, the average cost being about $32 a horse power. That means $70 to $80 horse power now. It should be remembered that these are high-grade plants, not average or poor ones. A year and a half ago it was testified in Washington that it has actually cost $100 a horse power at Niagara Falls, N. Y., to develop such power by coal. These prices are of course exceeded in Canada.

No matter what hydro-electric power is sold for, it will always be worth what it costs to develop it by coal, as there will never be enough

water power in the United States to do away with the use of coal, until at least we learn how to utilize the tides, either by storage batteries or otherwise.

**Foster Flats Development**

Coming back to the Niagara River, we claim that a dam four and one-half miles below the Falls will take care of the entire minimum flow of the lower river, or 220,000 cubic feet per second, and not cost any more than the Ontario government canal, which handles only 16,000 cubic feet per second.

Similar diversions have been sought after on the American side of the line, but obviously they will cost much more per horse power developed than the Canadian efforts, for the reason that the land is much more valuable in New York than in Ontario, and besides there is an enormous net-work of railroad crossings and highways, etc., which are always expensive items. Furthermore, the cost of labor and material has appreciably increased. On the New York side of the line, strenuous efforts are being made to obtain permission to build tunnels, taking the water from below the Falls, and returning it in the lower Niagara River. Advocates for this scheme acknowledge that they can only obtain 75 foot head out of the total 100, which means a permanent loss of that proportion of power.

Then these advocates do not dare ask that the diversion for both sides of the river should be allowed for more than one-half the flow of the river. So, obviously, if they have 75 per cent. head, and half the flow, they would only get thirty-seven one-half per cent. of the value of the lower river, for both sides of the river combined.

This also would be justifiable were there no way of obtaining the full value, but there certainly is. The real solution is to build a dam four and one-half miles below Niagara Falls, on the lower end of what is known as Foster Flats, a really ideal location for a dam and power plants. The location of such a dam is shown in Fig. 1.

This whole project, dam, power plants, transmission lines, interest on the money, etc., would cost less than one hundred million dollars, for two million horse power, as against three to five million dollars for 750,000 horse power, the maximum amount that can be obtained from all minor diversions. As there is a 102 foot drop in the Niagara River, and a minimum flow of 220,000 cubic feet per second, two million horse power can be obtained.

Most people are appalled, first of all, at the idea of a dam in the Niagara River, but I have pointed out to them what an easy matter it would be at this site. For while at many places, the Niagara River is from 150 to 190 feet or more in depth, at Foster Flats it is only about 35 feet. Foster Flats is the only place in the Niagara River where there is a gentle incline before the almost vertical bluffs.

It would be possible to build the first part of the dam on Foster Flats on the Canadian side of the river, on what is now dry land, having

the base of the dam some twenty or thirty feet below the bed of the river at that point, making it possible to leave openings in the bottom of this part of the dam to divert water from the present channel of the Niagara River. Then it will be a comparatively simple matter to build the second or last section of the dam in what is now the channel, 500 feet wide, of the Niagara River. The length of the dam will be about 1,500 feet. At present the water level on the site of the dam is some 25 feet above the Lewiston level, so it will, of course, be necessary to blast out some of the rocks below the dam in order to obtain the full hundred foot head.

Many people, even some of my opponents, have acknowledged that sooner or later this dam will have to be built, and as it will naturally be able to handle the entire flow, therefore any and all minor or partial diversions will simply be unnecessary after the completion of this dam. Why, therefore, saddle the ultimate consumer with a cost three to five times as high as necessary?

**Goat Island Scheme**

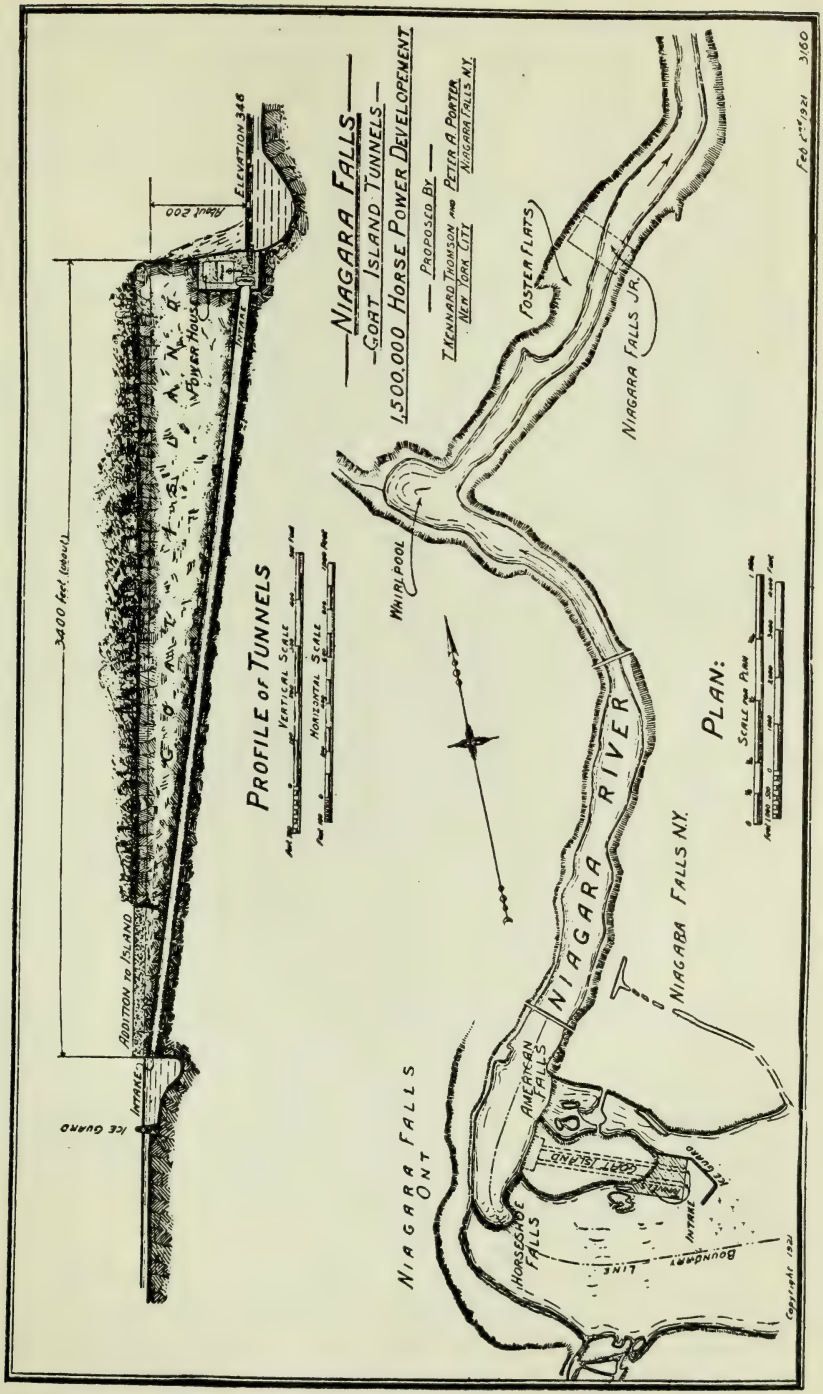
I might state here that while the dam will be absolutely the most economical method of developing the maximum amount of power at the minimum of cost, from the lower river, the method which will develop the maximum amount of power at the minimum of cost for any further diversions of water to be diverted from the Niagara River above the Falls, is our project for tunnels under Goat Island, shown in Fig. 2. By extending Goat Island we would increase its natural beauty for some thousand feet or more, and utilize the 60 foot drop immediately above the crest of the Falls.

It has been recommended that half the flow of the Niagara River be diverted from above the Falls, which if carried through our Goat Island tunnels, would give two million horse power, which added to our two million from the Lower Gorge, would make four million in all.

Many claim that half the flow of the river can be diverted without injuring the view of the Falls. It seems to us that the volume of water has a great deal to do with the marvellous beauty and that any diversion at all must have more or less effect on one of the grandest spectacles in the world. So we claim that our Niagara Falls Junior should be constructed, first, as it does not draw any water away from the Falls, nor the old power plants, and that after our two million horse power is used, and the public is clamoring for more power, then any further diversion from above the Falls which may be decided on should be carried through the shortest possible tunnels, as shown in our Goat Island project.

Surely is it not obvious that 3,500-foot inclined tunnels and a 1,500-foot dam are more economical than tunnels six to ten miles long, or canals twelve three-quarter miles long?

While we have shown the decidedly uneconomical projects which have been completed, or proposed, there is another vitally important point. We know that hydro-electric development attracts manufacturers and industries only on the assurance of cheap power and uninterrupted service,


NIAGARA FALLS
GOAT ISLAND TUNNELS
1,500,000 HORSE POWER DEVELOPEMENT
PROPOSED BY
LEONARD THOMSON AND PETER A PORTER
NEW YORK CITY
NIAGARA FALLS N.Y.
PROFILE of TUNNELS
VERTICAL SCALE
HORIZONTAL SCALE
3400 feet (about)
ADDITION to ISLAND
INTAKE
ICE GUARD
ELEVATION 346
ABOVE 200
POWER HOUSE
WHIRLPOOL
FOSTER FLATS
NIAGARA FALLS JR.
NIAGARA RIVER
PLAN:
SCALE 200 FEET
NIAGARA FALLS ONT.
AMERICAN FALLS
GOAT ISLAND
HORSESHOE FALLS
BOUNDARY LINE
NIAGARA FALLS N.Y.
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and that anything that would seriously interfere with these advantages would have very serious results. To take the extreme for instance, if large manufacturing concerns which are working full blast, entirely operated by hydro-electric power, should, without a moment's notice have the entire power cut off, with no chance of having the damage repaired for a couple of years, the disaster would of course be appalling, and naturally the greater amount of power so lost, the greater the calamity.

### Ice Jam Hazardous

Yet once more I claim that it might be justifiable to take such a risk, if there were no way of avoiding it. But there is. It should not need a great imagination to realize that if half the flow of the river were diverted from the rapids, where rocks are now near the surface almost all the way across the river, many of these rocks must necessarily be 15 to 20 feet above the water, and anybody who once witnessed the enormous volume of ice that goes down the Niagara River in the spring, must realize the great danger of a quickly forming ice jam, which might pile up a hundred or more feet in height. Even with such self-evident conditions as the above, an engineer must, if possible, be able to give proofs of such drastic assertions.

We know that some dozen years ago, when no water was being diverted from the rapids, an ice jam occurred, which lasted only eight hours, piling the ice 40 feet above the tracks of the Gorge Railroad, backing the water up to the base of the old Falls, and more or less damage was done to the existing plants, and when the ice jam broke, it absolutely carried everything away from the banks of the river below, to a height of at least 20 or 30 feet above the water's edge, docks, wharves, trees, shrubs, grass. While it has been claimed that the damage was not very great, the only reason that it was not greater was that there was nothing left to damage.

Again, some million of years ago, an ice jam diverted the whole Niagara River at right angles, thereby creating the whirlpool and causing the flow to cut a brand new channel out of bed rock. Undoubtedly there have been many other ice jams not recorded in history.

So, obviously, as a number of times the entire flow of the river has not been enough to carry the ice away, how in the name of reason can half the flow of the river be expected to accomplish the purpose! Therefore it seems that all minor diversions either by tunnel or canal will not only cost three to five times as much, but will be almost sure to result in these diversions, causing financial suicide by destroying every plant in the river. Why go to such unnecessary expense with the danger of destruction so great, when another plan will be safe and economical.

### Foster Flats Dam

The way to handle ice safely is to have deep water and plenty of current, and one of the modern methods of obtaining this is by submerged weirs. Our dam is a submerged weir. By building the first half of the dam high above the water with ice guards confining the ice to a channel

directly over the old channel and leaving a fore-bay directly over Foster Flats for an ample intake, we will have a minimum depth of water above our dam of over one hundred feet.

An ordinary dam of this height would have a base of possibly 80 to 90 feet to withstand the pressure, but we want to make our dam 700 feet wide at the base, which will not only give us excessive strength, but will also give us such a flat slope on the up-stream side that no ice can ever be retained, and with such a flat slope on the down-stream side that the ice will have no sudden drop to undermine the foundations, but will have a gradual slide down to deep water.

As we do not anticipate the minimum flow of water when the ice is flowing, there will probably be enough water to carry the ice over our dam, but if at any time this is not so, it will be a very simple matter to shut down one or two of the turbines for the time being, for a few hours, or even if it amounted to a couple of weeks, it would not be very serious.

In this connection, however, we expect to take care of the shortage by auxiliary coal plants. As a matter of fact, the full value of water power will never be obtained without the aid of auxiliary coal plants, for as we all know, uniform power must be supplied to manufacturers and others, and the maximum amount required for peak-load occurs for about half an hour or one hour a day only, so without the aid of auxiliary plants, a large amount of power must be wasted from 20 to 23 hours a day. One of the biggest problems the engineer and business man has to solve is how to use this power continually.

### St. Lawrence River Project

The first step in canalizing the St. Lawrence River should be our project of building a dam in the Lachine Rapids, dredging the channel from this dam down to the City of Montreal, thereby reclaiming ten square miles of land from the river, and creating a million and a half horse power. This proposal is indicated in Fig. 3.

Montreal is now 24 feet above sea-level, without the necessity of any locks below Montreal. Locks in our dam would permit ocean-going vessels to reach Lake St. Louis level about 74 feet above the tide level and three or four such projects would enable boats to reach Lake Ontario, via the Welland Canal, Lake Erie.

The late Sir William Van Horne stated that my Lachine project would make Montreal one of the greatest ports in the world. Eight million horse power could be obtained from the Niagara and St. Lawrence Rivers.

If this work were done under government ownership, God help the countries! But if this is done on strict business principles with proper government regulations, the entire continent will experience a boom, lasting as no boom has ever lasted in the past.

### Manhattan Extension

The addition of six square miles to the City of Manhattan may seem a far cry from Canada, but as a matter of fact the entire continent of North America is like a human system, a small sore on the smallest finger or toe being enough to upset the whole system, whereas anything which

benefits the health, wealth and happiness of any part must more or less benefit the entire continent. How much more, therefore, will the construction of a five billion dollar city on six square miles of the most valuable real estate in the world benefit us all?

The reason for this is that everything grown, mined or manufactured in North America as well as many parts of the world, will have to speed up production to supply the demand for this great city.

The only thing that I am afraid of is that when we actually start work with the usual American and Canadian rush and hurry, we will overlook many thousands of details which will make this city surpass in each and every detail, anything which has been attempted before.

There is probably scarcely a man or woman on the continent who could not, if they would, suggest one or more of such improvements, so that everything from the watertight cellar floor to the roof garden, would show the benefit of their help.

In fact the world should be combed for intellects of every branch of industry, not only engineering and architecture, but also in business, education, legislature, administration, banking, manufacture, social service, that is, every calling which goes to make up the work of a great city, should see to it that its particular requirements are properly taken care of, taking advantage of everything that has been done in past centuries and then making further improvements.

**Features of Manhattan Extension**

Just to give your own imagination something to start on, we never expect to burn a pound of coal, nor a cubic foot of gas, nor have a horse on the streets.

We never expect to bury a pipe or wire in the ground, but have one street devoted entirely for these utilities, so that all that will be necessary will be to open the cellar door to make the mechanical connection.

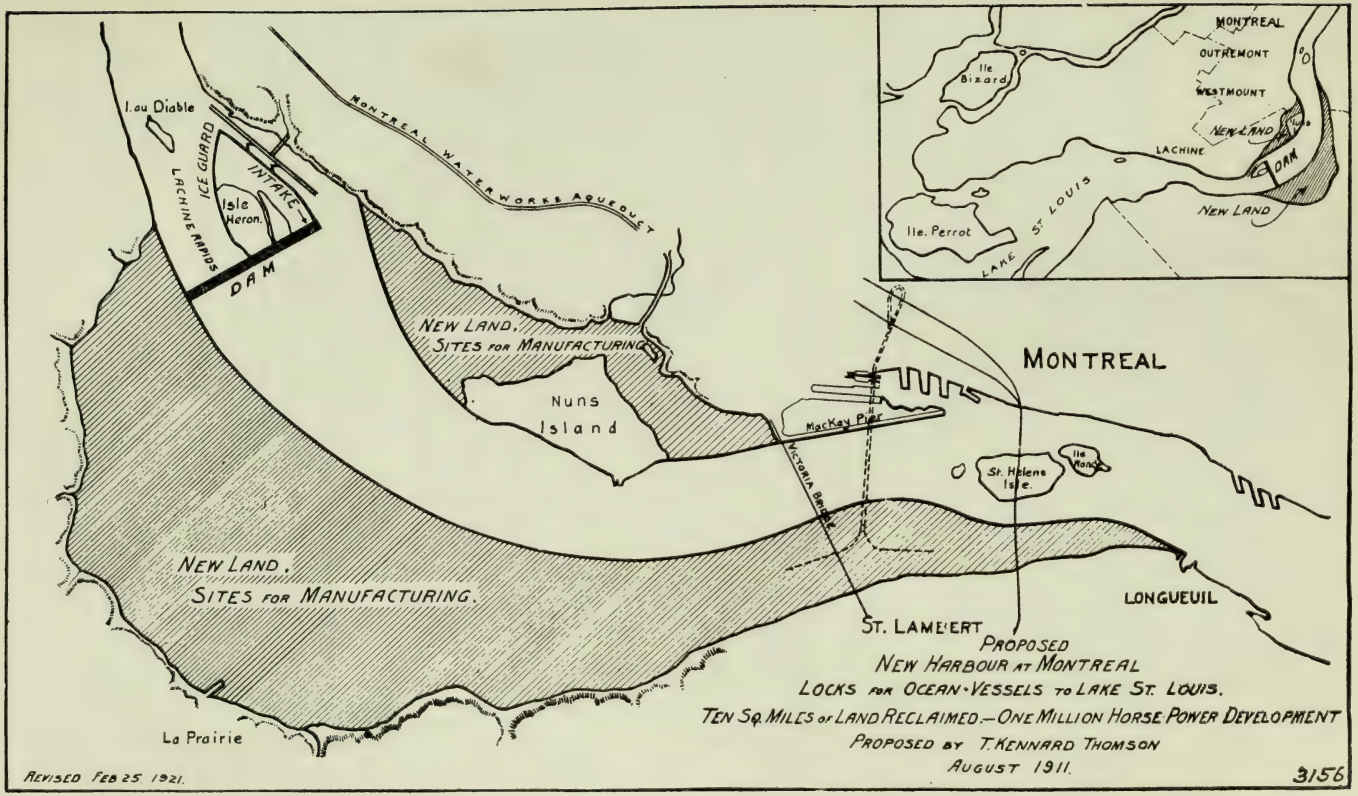
Above this we expect to have three street levels, not dark holes in the ground, but with sidewalks and stores on each side of them, as well lighted, heated and ventilated as the best department stores. The first street level above the pipe level will be for heavy trucking, with railroad tracks around the water front. The next level will be for rapid transit, and the top level will be for light traffic, automobiles, buses and so on.

Every building should cover a whole block and have a roof garden on top of it, with swimming pools where the young children could learn to swim.

The proposed plan calls for six square miles to be reclaimed from New York Bay, and added to the City of Manhattan.

This extension will be done section by section as fast as the land is needed for the buildings. For the first section or two we can probably build outside cofferdams to bed rock, permitting us to pump out the material in between, giving us several square miles of new land without any earth on top of the rock.

Down towards Staten Island where the rock is at greater depth, it may be possible to back fill by pumping sand from the ocean. If we have


MONTREAL
OUTREMONT
Ile Bizard
WESTMOUNT
NEW LAND
LACHINE
DAM
NEW LAND
Ile. Perrot
LAKE St. LOUIS
I. au Diable
LACHINE RAPIDS
ICE GUARD
INTAKE
Isle Heron.
DAM
MONTREAL WATER WORKS AQUEDUCT
NEW LAND. SITES FOR MANUFACTURING
Nuns Island
MacKay Pier
MONTREAL
Victoria Bridge
St. Helens Isle.
Ile Ronde
NEW LAND. SITES FOR MANUFACTURING.
LONGUEUIL
ST. LAMBERT
La Prairie
PROPOSED
NEW HARBOUR AT MONTREAL
LOCKS FOR OCEAN-VESSELS TO LAKE ST. LOUIS.
TEN SQ. MILES OF LAND RECLAIMED.—ONE MILLION HORSE POWER DEVELOPMENT
PROPOSED BY T. KENNARD THOMSON
AUGUST 1911.
REVISED FEB 25 1921.
3156

to do this, I have plans in my office of one of the greatest dredge experts, of section dredges 40 inches in diameter, such as have been operating in Egypt for years, pumping 50,000 cubic yards of sand a day.

### Fifth Avenue and 42d Street Crossing

One of the most congested crossings in the world is at Fifth Avenue and 42d Street, where the delay, if added up per vehicle or person per year, would be a simply appaling waste of time and money.

At this point 42d Street is ten feet higher at Fifth Avenue than at Madison Avenue and Sixth Avenue, so that if we were to reverse the grade and lower 42d Street fifteen feet at the Fifth Avenue crossing, the grade would be only one half of what it is now.

I have therefore proposed that the level of Fifth Avenue be kept as it is, and 42d Street run under it, turning the present cellars into the ground floors. I have made modifications of this plan to suit the views of the Fifth Avenue Association, which would keep the sidewalks and part of 42d Street the same level as it is now at the present, only lowering the centre so that the automobiles and trolley cars can pass under Fifth Avenue as well as foot passengers.

This means that automobiles and carriages can turn off Fifth Avenue on to 42d Street or vice versa, but can not cross Fifth Avenue on the present grade.

This improvement, in addition to the perpetual saving of time would save many people from missing their trains.

### North River Tunnel

My proposed tunnel for a place like the North River was fully described in the Transactions of the American Society of Civil Engineers, 1920, pages 468-73. In this case I proposed driving rows of piles, building the tunnel like heavy concrete boat, say 170 or 180 feet wide and 500 feet long, which should be sunk on top of the piles after the silt had been pumped out. The joints should be made by sinking pneumatic caissons over the two sections already down, or by attaching pneumatic caissons to each section following the first, so that they simply telescope the preceding section.

### Two Proposed Niagara River Bridges

In conclusion I wish to speak of two bridges which I want to build over the Niagara River, to show what we think of the boys who went "Over There." The three requirements for such structures should be beauty, strength and permanence. It has always seemed to me that the boundary line between Canada and the United States is the proper place for such structures.

The bridge at Niagara Falls should have a clear span of not less than 840 feet, and should be a massive steel structure, encased in concrete, with a hundred-foot roadway above.

The bridge between Fort Erie and Buffalo should have six main spans of 300 feet in the clear, each with a clear height of 90 feet above water, which the marine interests of the lakes have stated would be satisfactory.

# ALLOYS OF IRON AND CARBON

By O. W. Ellis, M.Sc.

As early as 1890 it had been discovered that iron was a polymorphous element and during the past thirty odd years the transformations of this remarkable metal have been the subject of almost ceaseless investigation.

It has been definitely established that on cooling pure iron from 1,530°C (its freezing point) three distinct evolutions of heat ensue—one at 1,400°C., one at 898°C., and one at 768°C. These evolutions of heat are referred to as critical changes in so far as the first two are concerned and as critical range in so far as the last is concerned.

For convenience these transformations are denoted by the symbols Ar4, Ar3 and Ar2 respectively — A = arrest (arrète), r = refroiddisement (cooling), Ar — arrest on cooling.

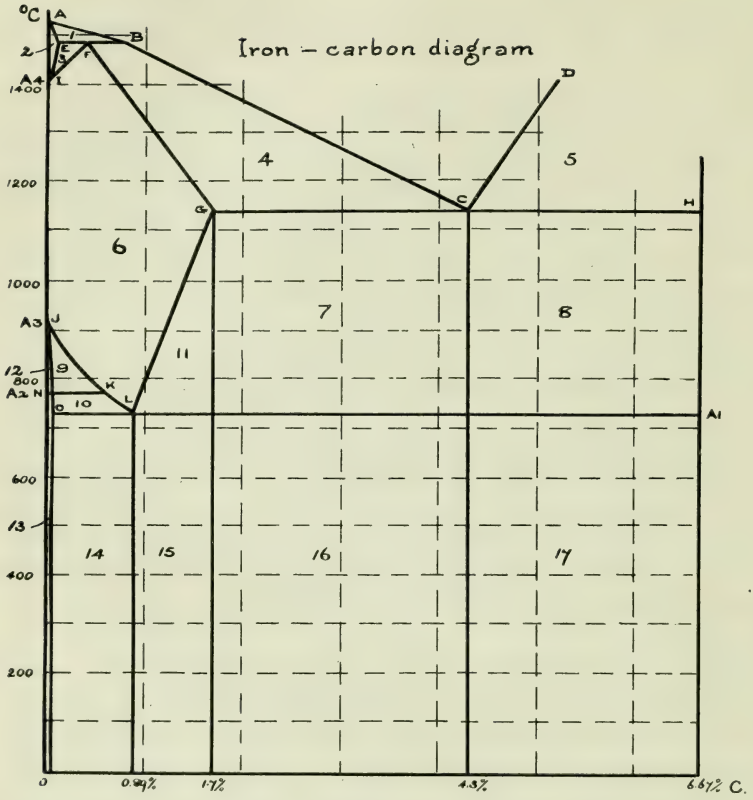
On heating pure iron these transformations occur with absorption of heat at 768°C, at 909°C and at 1,410°C; they are designated Ac2, Ac3 and Ac4 respectively—Ac=arrest on heating (chauffant).

When reference is made to these arrests, but it is not stipulated whether the same occur on heating or on cooling, they are designated A2, A3 or A4, as the case may be. It is convenient to assume that the A2 point occurs at 768°C, the A3 point at 903.5°C and the A4 point at 1,405°C —that is, that under conditions of equilibrium the arrests occur at transformations which are the mean of those at which they occur on heating or on cooling.

Above the A4 point iron is said to exist in the delta state, between the A4 and the A3 points in the gamma state, between the A3 and the A2 points in the beta state and below the A2 point in the alpha state.

To the phenomenon of the existence of an elementary substance in different crystalline state the term allotropy is applied. It having been shown that the alpha, gamma and delta state of iron are characterized by differences in crystalline arrangement, iron is said to exist in at least three allotropic forms. The existence of beta iron as a definite allotrope is disputed, owing to the fact that the change at A2 is associated, not with any crystallographic readjustment, but with a change in the magnetism of the metal. Iron commences to change from the ferro-magnetic to the para-magnetic state at relatively low temperatures. At A2 its rate of change of magnetism is at a maximum. Its magnetism reaches a minimum at 790°C.

Liquid iron is able to retain only a small percentage of carbon in solution. The limits of liquid solubility of carbon in iron have not been accurately determined.




**Constitution Diagram**

## PHASES PRESENT IN AREAS OF DIAGRAM

Phase Area — Phases

1. Liquid plus Solid solution of Carbon in Delta Iron.
2. Solid solution of Carbon in Delta Iron.
3. Solid solution of Carbon in Gamma Iron (Austenite) and Delta Iron.
4. Liquid plus Solid solution of Carbon in Gamma Iron (Austenite).
5. Liquid plus Cementite.

6. Solid solution of Carbon in Gamma Iron (Austenite).
7. Solid solution of Carbon in Gamma Iron plus Cementite plus Eutectic (Ledeburite).
8. Cementite plus Eutectic.
9. Solid solution of Carbon in Beta Iron (Beta Ferrite) Delta Iron (Austenite).
10. Solid solutions of Carbon in Alpha Iron (Alpha Ferrite) and Delta Iron.
11. Solid solution of Carbon in Gamma Iron plus Cementite.
12. Solid solution of Carbon in Beta Iron (Beta Ferrite).
13. Solid solution of Carbon in Alpha Iron (Alpha Ferrite).
14. Solid solution of Carbon in Alpha Iron (Alpha Ferrite) plus Pearlite.
15. Pearlite plus Cementite.
16. Pearlite plus Cementite plus Eutectic (Ledeburite).
17. Cementite plus Eutectic (Ledeburite).

Iron and carbon may combine to form a metastable compound, iron carbide, $Fe_3C$, which, under certain conditions, is subject to dissociation

$$Fe_3C=3Fe+C.$$

This process of dissociation is referred to as graphitization, the carbon resulting from the decomposition of iron carbide being in the form of graphite.

To this carbide the name cementite is generally applied.

Iron and cementite form a metastable system of alloys. The system is metastable on account of the metastability of cementite. The constitution diagram of the system is shown on page 24.

In this diagram the lines AB, BC and CD represent the temperatures at which the alloys of this system commence to freeze. It will be noted that depression of the freezing-point of iron ensues as a result of the addition of carbon to iron. The components of the system—iron and cementite —form an eutectic containing 4.3 per cent. of carbon. The freezing point of the eutectic, to which the name ledeburite is frequently applied, is 1,135°C.

The lines AE, EF, FG, and GH (the eutectic horizontal) indicate temperatures at which these alloys become completely solid.

The addition of carbon to iron elevates the A4 point. This is indicated by the line IE, the slope and position of which make clear the fact that addition of 0.07 per cent. of carbon raises the A4 point to 1,486°C. This percentage of carbon is also the maximum amount of carbon that delta-iron is able to hold in solution.

The solubility of carbon in gamma-iron is indicated by the line GL, the slope and position of which make clear the fact that gamma-iron can retain as much as 1.7 per cent. of carbon in solution at 1135°C, but only as much as 0.89 per cent. in solution at 720°C.

The diagram also shows that the A3 point of iron is reduced as a result of the presence of carbon. The line JKL indicates the manner in which the depression of A3 proceeds with addition of carbon. It will be seen that the addition of 0.89 per cent. of carbon to iron results in the lowering of A3 to 720°C.

Both beta-iron and alpha-iron are practically unable to hold carbon in solution. Alpha-iron, for example, will retain only about 0.03 per cent. of carbon in solution at 20°C. The solubility of carbon in iron at 720°C is little, if any, greater than it is at 20°C.

From the above it will be seen that the 0.89 per cent. alloy is unique in that it is the alloy possessed (i) of the lowest A3 point (720°C) and (ii) of the maximum amount of carbon that gamma-iron is able to dissolve at 720°C. Now, since the gamma-iron of the 0.89 per cent. alloy is subject to transformation into alpha-iron at 720°C and, since carbon is practically insoluble in alpha-iron at 720°C, alpha-iron and carbon, in the form of cementite, are, when this alloy is slowly cooled, precipitated contiguously in the characteristic manner shown in Fig. 7. This structure is referred to as pearlite.

The solid solution of carbon in gamma-iron is referred to as austenite. That of carbon in beta-iron is referred to as beta ferrite, that of carbon in alpha-iron is referred to as alpha ferrite. Pearlite consists of alpha ferrite and cementite.

To recapitulate—at temperatures above 720°C the solid 0.89 per cent. carbon-iron alloy consists of austenite. On cooling the alloy slowly and uniformly, no radical change occurs in its structure until 720°C is reached. At this temperature the gamma-iron changes into alpha-iron and on this account carbon is thrown out of solution in the form of cementite. The products of dissolution, of the austenite—alpha-ferrite and cementite —arrange themselves in the characteristic manner of Fig. 7, a structure to which the name pearlite is applied. The 0.89 per cent. alloy is a eutectoid alloy.

Alloys of iron and carbon which consist entirely of austenite at any stage of their cooling from the liquid state are conveniently referred to as steels. The steels are, then, those alloys of iron and carbon that contain less than 1.7 per cent. of carbon. Commercial steels, however, rarely contain more than 1.4 per cent. of carbon.

Steels containing less than 0.89 per cent. of carbon are referred to as hypo-eutectoid steels, while steels containing upwards of 0.89 per cent. of carbon are referred to as hyper-eutectoid steels.

At temperatures above those represented by the lines JKL and LG the steels consist of austenite. The hypo-eutectoid steels on being cooled slowly and uniformly form temperatures above JKL are subject to structural change when they reach the temperatures represented by the line JKL. Those steels containing less than about 0.58 per cent of carbon undergo transformation at temperatures represented by the line JK. At these temperatures gamma-iron changes into beta-iron and since carbon is practically insoluble in beta-iron the austenite becomes enriched in carbon. As the temperatures of these alloys are depressed, further transformation of gamma-iron to beta-iron ensues, until the temperature 768°C (NK) is reached. At this temperature the precipitated beta-iron changes the alpha-iron. This transformation results in no change in the carbon content of the austenite, which, however, becomes enriched in carbon as a result of further fall in temperature and consequent transformation of gamma-iron to alpha-iron. By the time the temperature of the steel has reached 720°C the enriched austenite contains 0.89 per cent. of carbon—it is of the eutectoid composition—and at this temperature it changes into pearlite. These steels at temperatures below 720°C undergo no further change that need be considered here. They consist of alpha-ferrite and of pearlite in varying proportions.

Those steels containing from about 0.58 to 0.89 per cent. of carbon undergo transformation at temperatures represented by the line KL. The gamma-beta and gamma-alpha transformations being merged in the case of these steels, it may be said that at these temperatures the gamma-iron changes to alpha-iron and as a result the austenite becomes enriched in carbon. Slow and uniform fall of temperature is accompanied by further transformation of iron and further enrichment of the austenite, which by the time 720°C is reached is of the eutectoid composition and changes into pearlite. These steels, being subject to no change below 720°C, also consist of alpha-ferrite and of pearlite in varying proportions.

The 0.03 per cent. carbon steel consists entirely of alpha-ferrite, the 0.89 per cent. carbon steel consists entirely of pearlite. The structural composition of any hypo-eutectoid steel may be determined quite readily given this information. The 0.60 per cent. steel, for example, would consist of

$$\frac{0.89 - 0.60}{0.89 - 0.03} \times 100 = 33.8 \text{ per cent. of alpha-ferrite.}$$

$$\frac{0.60 - 0.03}{0.89 - 0.03} \times 100 = 66.3 \text{ per cent. of pearlite.}$$

The structure of this steel (as cast) is shown in Fig. 3. The proportions of the microconstituents in these steels as cast, differs slightly from those in these steels as slowly cooled. The proportion of pearlite is somewhat greater. This is occasioned by the relatively rapid cooling to which cast steel is subject.

The hyper-eutectoid steels consist of austenite at temperatures above those represented by the line LG, at which temperatures the steels become supersaturated in respect of carbon. On slowly cooling these steels, carbon in the form of cementite separates from the austenite at the temperatures represented by the line LG, and, in consequence, impoverishment of the austenite in carbon ensues. As the steels are cooled further separation of cementite supervenes until, when the steels have attained the temperature 720°C, the austenite is of the eutectoid composition and undergoes transformation into pearlite on account of the gamma-alpha change.

The hyper-eutectoid steels, being subject to no change below 720°C, consist at ordinary temperatures of varying proportions of cementite and pearlite.

The 6.67 per cent. carbon iron alloy (cementite) consists entirely of cementite, the 0.89 per cent. steel consists entirely of pearlite. The structural composition of any hyper-eutectoid steel may be determined quite readily given this information. The 1.15 per cent. steel, for example, would consist of

$$\frac{6.67 - 1.15}{6.67 - 0.89} \times 100 = 95.5 \text{ per cent. of pearlite.}$$

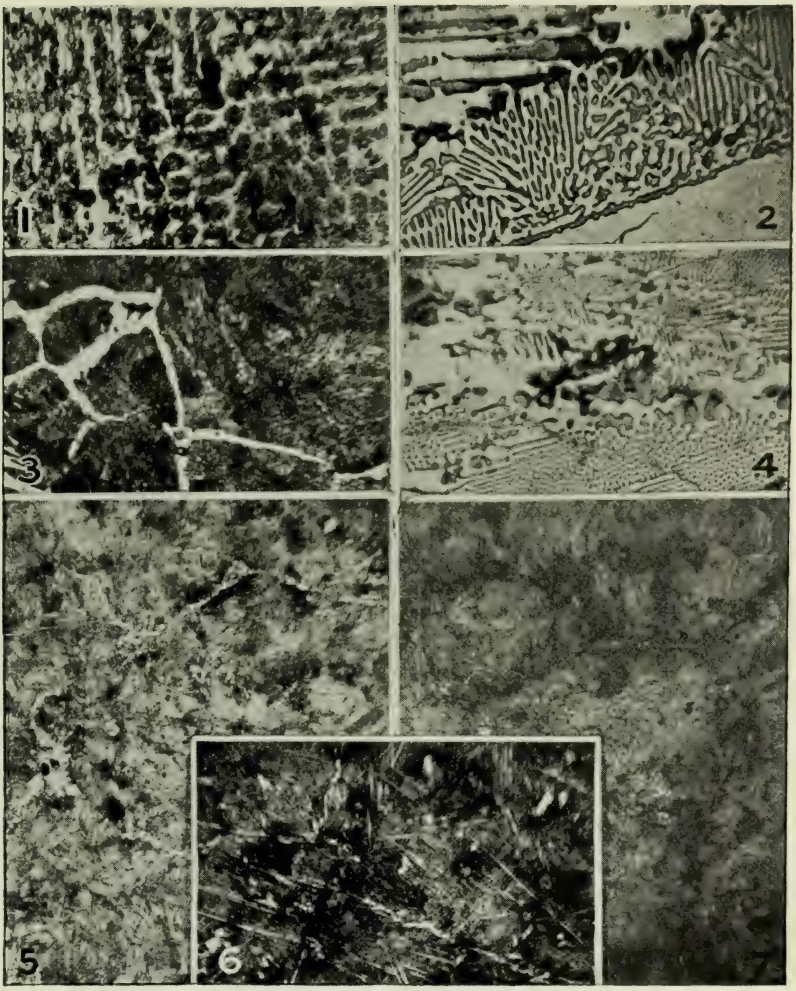
$$\frac{1.15 - 0.89}{6.67 - 0.89} \times 100 = 4.5 \text{ per cent. of cementite.}$$

The structure of this steel (as cast) is shown in Fig. 5.

The 1.7 per cent. alloy, it will be noted consists at ordinary temperatures of the products of dissolution of 1.7 per cent. austenite—

$$\frac{6.67 - 1.7}{6.67 - 0.89} \times 100 = 86.5 \text{ per cent. of pearlite and}$$

$$\frac{1.17 - 0.89}{6.67 - 0.89} \times 100 = 13.5 \text{ per cent. of cementite.}$$ This alloy is of special importance in that at 1135°C 1.7 per cent. austenite is a constituent of *all* the alloys of carbon and iron containing more than 1.7 per cent. of carbon. The structure of this alloy is shown in Fig. 6.




*Magnification* 100.

**Photo-micrographs of Various Steels.**

At all temperatures above 1135°C the 4.3 per cent carbon-iron alloy is liquid. At 1135°C iron becomes supersaturated with respect to carbon and from the liquid carbon in the form of cementite is precipitated. The liquid on this account is momentarily enriched in iron. Now, since all the alloys of carbon and iron containing less than 4.3 per cent. of carbon freeze at temperatures above 1135°C and since gamma-iron is able to retain as much as 1.7 per cent. iron in solution (solid) at 1135°C, precipitation of austenite ensues. The alloy on this account is momentarily enriched (supersaturated) in carbon. Hence, further precipitation of cementite ensues. This is followed by further deposition of austenite, and so on. This alternate precipitation of the constituents, austenite and cementite at 1135°C, results in the formation of a solid of characteristic structure. The structure—ledeburite—is shown in Fig. 4. In this photograph the white areas represent cementite, the dark areas the products of dissolution of the 1.7 per cent. austenite, 86.5 per cent. of pearlite and 13.5 per cent. of cementite. It is, however, impossible to distinguish at the magnification of this photograph the constituents that have resulted from the dissolution of the austenite.

The alloys containing less than 4.3 per cent. of carbon other than the steels, are referred to as hypo-eutectic alloys. They may be considered white cast irons. Commercial cast iron, however, rarely contains less than about 2.5 per cent. or more than about 4 per cent. of carbon.

The alloys containing more than 4.3 per cent. of carbon, are referred to as hyper-eutectic alloys.

Freezing of the hypo-eutectic alloys commences at the temperatures represented by the line BC. It is complete at 1135°C, at which temperature 1.7 per cent. austenite and ledeburite are in equilibrium. At 1135°C the 1.7 per cent. alloy consists entirely of austenite and the 4.3 per cent. alloy entirely of ledeburite. The structural composition of any hyper-eutectic alloy may be determined quite readily from this information. The 3.0 per cent. white cast iron, for example, would consist of

$$\frac{4.3 - 3.0}{4.3 - 1.7} \times 100 = 50 \text{ per cent. of the products of dissolution}$$

of 1.7 per cent. austenite.

$$\frac{3.0 - 1.7}{4.3 - 1.7} \times 100 = 50 \text{ per cent. of ledeburite.}$$

The structure of this alloy is shown in Fig. 1. While not true in the strictest sense it may be said that the white areas represent the lede-

burite and the dark areas the products of dissolution of 1.7 per cent. austenite, to wit 86.5 per cent. of pearlite and 13.5 per cent. of cementite.

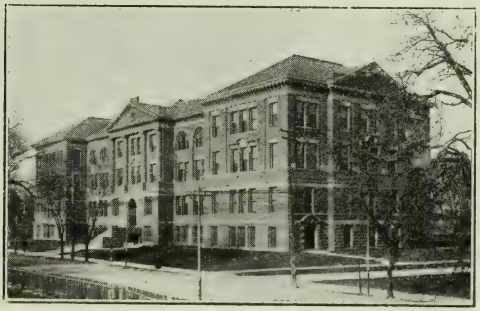
The hyper-eutectic alloys become supersaturated in respect of carbon at temperatures represented by the line CD. At these temperatures cementite is precipitated. The carbide continues to separate out of the liquid solution until when the alloy is at a temperature of 1135°C the liquid has attained to the eutectic composition. At 1135°C freezing of the alloy is completed and since, apart from the change which occurs in the 1.7 per cent. austenite of the ledeburite, no change ensues on further cooling of the alloy, these hyper-eutectic alloys consist at ordinary temperatures of cementite and ledeburite.

Give that the 4.3 per cent. alloy consists entirely of ledeburite and the 6.67 per cent. alloy entirely of cementite it is possible to estimate the structural composition of any hyper-eutectic alloy. For example, the 5 per cent. alloy would consist of

$$\frac{6.67 - 5}{6.67 - 4.3} \times 100 = 70.5 \text{ per cent. of ledeburite.}$$

$$\frac{5 - 4.3}{6.67 - 4.3} \times 100 = 29.5 \text{ per cent. of cementite.}$$

The structure of a hyper-eutectic cast iron is shown in Fig. 2.



# WITH THE ROYAL ENGINEERS IN PALESTINE

By J. Roy Cockburn, M.C., B.A.Sc., M.E.I.C.

A brief summary of the work of the Engineers in the Egyptian Expeditionary Force during the Great War.

The Palestine campaign, although noted chiefly for the brilliant work of the mounted troops, was nevertheless one of the best examples in history of the employment and co-operation of all arms of the service.

It is the object here to outline briefly the work of one particular branch—the Engineers.

After the second unsuccessful attempt of the Turks in 1915 to invade Egypt and cross the Suez Canal, the British force, known as the Egyptian Expeditionary Force, drove him back across the Sinai Desert and then deployed on a broad front extending from the sea coast at Gaza along the edge of the "Promised Land" to the vicinity of Beersheba.

In the autumn of 1917, after the third battle of Gaza, the British drove the enemy back another sixty miles in the space of nine weeks. This advance was made in all kinds of weather, varying from a sand storm on the desert, to a snow storm in the Judean Hills, and eventually in the autumn of 1918 the Egyptian Expeditionary Force succeeded in the total destruction of the VII and VIII Turkish armies and the liberation of Palestine and Syria from Turkish rule. It is evident that such an army would make great demands upon its engineers.

### The Desert Railway and Water Supply

The problem of transportation and water supply along the lines of communication extending from the Suez Canal to the front line was solved by building a standard gauge double-track railway from the base at "Kantara" across the desert and laying a pipe line alongside. This railway was eventually extended to "Haifa," on the Bay of Acre. The track was laid across the desert at the rate of one mile per day and part of the branch running to Beersheba was laid at twice that rate.

The old metre gauge railway running to Jerusalem was torn up and replaced by one of standard gauge which was incorporated in the general system.

During the war the railway was operated by the Royal Engineers, but after the cessation of hostilities it was taken over and operated by the Egyptian State Railway.

Previous to the III Battle of Gaza the main line of the "Kantara Military Railway" as it was called, had been laid as far as Dier el Belah, seven miles from Gaza.

Before the completion of the pipe line the water supply was carried forward in trains of tank cars. These trains were filled at special sidings

British Captured by the Turks Arriving at Jerusalem

and on arriving at railhead were emptied into canvas reservoirs placed beside the track. Here small metal tanks were filled and carried forward on camels to the troops beyond railhead.

When one section of the pipe line was completed a new water siding was provided and the railway relieved of carrying water along that section and so on until water was finally pumped to railhead.

The following is a brief description of the water system when completed:

Water is brought from the Nile near Cairo in the Port Said Branch of the Sweet Water Canal. At Kantara this canal is very close to the west bank of the Suez Canal. Here the Royal Engineers built a thoroughly up-to-date filtration plant having sufficient concrete coagulating basins and mechanical sand filters to treat 600,000 gallons of Nile water per day, and render it apparently perfectly clear to a depth of one metre. As this water is very muddy frequent backwashing of the filters is necessary. The water is pumped from the filtration plant through inverted syphons to masonry reservoirs situated on the east side of the Suez Canal. Centrifugal pumps driven by semi-Diesel oil engines are used for this purpose. The water is chlorinated and then pumped across the desert through a steel pipe line nearly one hundred and fifty miles in length.

This pipe line is lap welded, has screwed joints and is divided into sections each about twenty-four miles in length. The first section of the pipe is twelve inches in diameter, the next ten inches in diameter, and so on, the last section consisting of twin four-inch pipes. Reservoirs and duplicate sets of pumping engines are placed at the ends of each section. At certain points along the desert section of the railway water can be obtained but it is saline and quite unfit for use in locomotives, although used for drinking.

### The Water Supply of Jerusalem

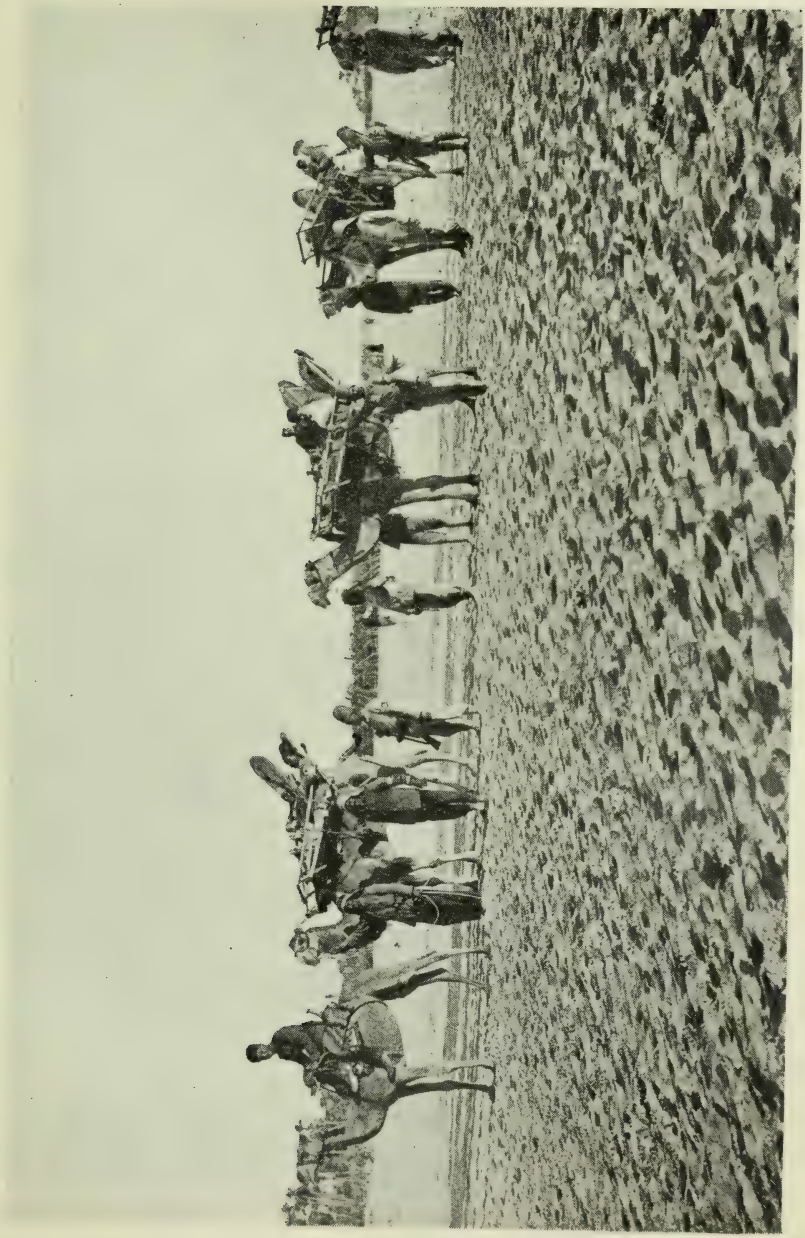
After the army had advanced into the Judean Hills many problems of water supply were successfully solved, one of the most important and most interesting being that of the water supply of Jerusalem.

When the writer first had the privilege of entering the ancient capital of Palestine early in 1918 the water supply came from three main sources.

1. Rain water stored in the cisterns of Jerusalem, a quantity of about 360,000,000 gallons.
2. About 40,000 gallons per day from Solomon's Pools.
3. The Pool of Siloam, which was little better than liquid sewage.

During the winter months the rainfall in Palestine is very heavy and we had much more water than was needed or convenient, but it was necessary to make provision for the coming rainless summer, not only for the troops but also for the 80,000 civilian population of Jerusalem.

The scheme carried out by the Royal Engineers is a modification of the system installed by the Roman Engineers under Herod and Pontius Pilate about 2,000 years ago.



Transporting Wounded on the Desert.

These ancient engineers had brought water through rock-cut channels from the springs of the Wadi Arrub to a reservoir of 4,000,000 gallons capacity, from which it flowed by gravity to Jerusalem through a masonry acqueduct. The Royal Engineers repaired the ancient reservoir and cleared out the channels. They installed a pumping plant to raise the water to a newly erected reservoir of 300,000 gallons capacity from whence it flows by gravity to another reservoir of 200,000 gallons capacity situated on high ground north-west of Jerusalem. The water flows from this reservoir to all parts of the city. Over twelve miles of steel pipes were laid and the whole undertaking completed in the space of nine weeks.

This installation furnishes a supply of 250,000 gallons of water per day and although laid down primarily for military purposes it will be of permanent value to the city.

### Roads

Besides the standard gauge military railway and many light railways a great deal of work was done by the Royal Engineers on roads of various kinds.

Satisfactory roads for infantry and motor traffic were built on the desert by stretching ordinary chicken netting over the sand and spiking it down with long staples. When such a road became rough, due to the shifting of the sand, the netting could be lifted and the sand underneath smoothed out again.

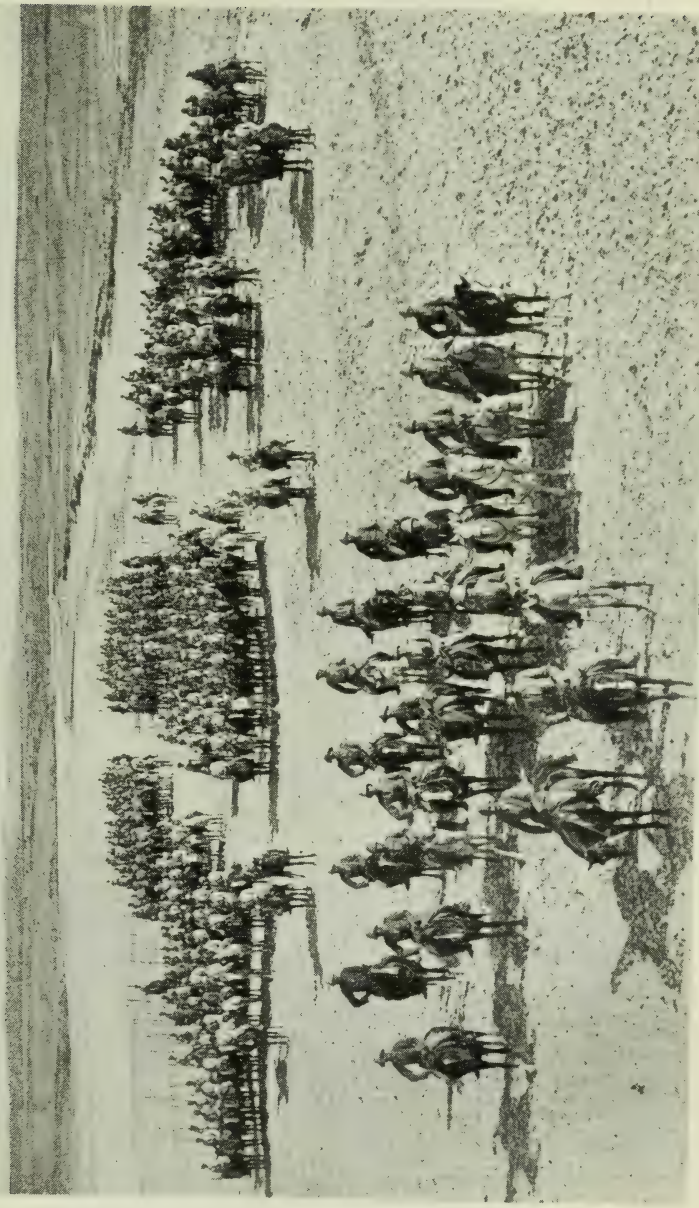
Many permanent roads were built both on the fertile plains and through the hills. In all undertakings the engineers made great use of the Egyptian Labour Corps as well as of the labour which the civilian population of Palestine afforded. It was a common sight to see Palestinians of all ages and of both sexes industriously and cheerfully working at the construction of roads under the supervision of members of the Corps of Royal Engineers, and as far as one could judge all were on the most friendly terms.

### Signal Service

A branch of the Royal Engineers worthy of special mention is the Signal Service. The rapid and wide movements of the troops and the great distances traversed made the problem of intercommunication peculiarly difficult. The sudden change from sandy desert to rough mountain tracks called for great elasticity in transport and ingenuity in building telegraph lines. During the most rapid advance, communication was established between the various units by either repairing old Turkish telegraph lines or running new temporary lines. All such lines were replaced later by more permanent ones wherever the circumstances warranted.

### Field Survey Campaign

During the great war each British army had a field survey company, operating directly under the intelligence department of the army. In France the Field Survey Companies were latterly called Battalions.



Turkish Cavalry near Beersheba

The 7th Field Survey Company, R. E., of the Egyptian Expeditionary Force, like all other survey companies and battalions, looked after such work as field surveys, compilation and reproduction of maps, photography, letter-press printing, meteorological work, and the location of hostile batteries by means of observation and sound ranging.

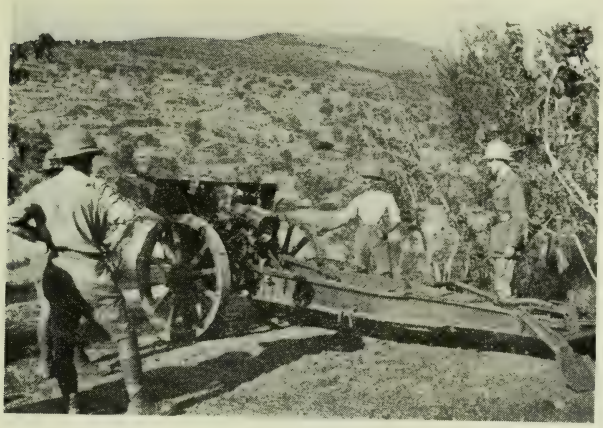
The work of the field parties consisted chiefly of triangulations, plane table surveys, fixing battery positions and datum points for our artillery, and intersecting points in and beyond the enemy's lines. Before the final advance in the autumn of 1918 points had been accurately intersected at distances up to fifteen miles behind the enemy's front line.

Contour maps were printed on the scales—1/40,000, 1/20,000, and 1/10,000. The operation maps on the 1/40,000 scale were printed in four colors. The wadis, roads, railways, villages, wells and such topographical features were printed in black, contours in brown, trees in green and enemy trenches, gun emplacements, barbed wire entanglements and earthworks in red over black. Different classes of roads were also indicated in red.

Contours were surveyed at twenty metres vertical interval in the hilly country, and at ten metres in the plains; spot heights were also taken of the hills. Some sheets were overprinted with a special grid subdivision and enemy battery positions numbered in blue.

The Royal Air Force photographed the whole of the enemy's line and country in the rear to a depth of twenty-five miles, and in addition the main roads and railways leading from the north. Between Jan. 1st, 1918, and the cessation of hostilities, 15,690 photographs were dealt with and the topographical information published in map form. The photographic section of the Royal Air Force showed the greatest willingness to co-operate with and meet the requirements of the Field Survey Company with the result that photographs were used in the compilation of topographical detail maps in the Egyptian Expeditionary Force to perhaps a relatively greater extent than on any other front. Maps showing the disposition of the enemy's forces, to accompany intelligence summaries, were printed periodically. During active operations these maps were printed at night for distribution to units in the field in time for the following day's operations. Such maps were issued for some sixty days. Twenty-six telephoto panoramas were taken from a number of positions commanding good views over the enemy's ground. Two topographical sections were formed in 1918 to compile and print small maps of the enemy's defenses as required. Astronomical observations were made at various places to determine the latitude and longitude.

The meterological section took daily readings of the maximum and minimum temperatures. Humidity, barometric pressure, evaporation, wind and rainfall were recorded four times a day. Daily weather reports were



Captured German 15 c.m. Howitzer in Wadi el Jib near H.Q. "V" Section firing on Turks.

H.Q. "V" Section from across Wadi el Jib.

"A" Post "V" Section Khurbet Abu Felah

issued. Measurements of the upper air currents were made by the observation of the flights of small pilot balloons. During artillery activity balloon flights were observed at intervals of four hours during the day and night.

**Sound Ranging**

In August, 1917, two sound-ranging sections, "V" and "N" were sent from France to the Palestine front and in August, 1918, a third section was formed locally in order to use a spare set of sound ranging instruments which had just been sent to Palestine.

Previous to August, 1917, "V" Section, R. E., was part of the 3rd Field Survey Company in France, the headquarters of "N" Section being at Velu, between Bapaume and Cambrai. "N" Section was part of the 2nd Field Survey Company. Scientific sound ranging, as carried on in the various British armies as well as in the armies of our allies, should not be confused with the rough and ready method of observing sound bearings where direction is judged by hearing alone. Our method differed greatly from that employed by the enmy. We obtained records of great precision in which no human element existed, whereas the enemy depended entirely upon the skill of his observers, and a very rigorous discipline designed to make the observer do their best.

We employed an extremely accurate electrical device to give us photographic records, from which intervals of time could be easily read to the nearest 1/100 of a second, and in many cases. to the nearest 1/1,000 of a second, if required. The enemy employed a man with a stop watch for this purpose.

Fig. 1 is a rough plan of the first position of "V" section in Palestine. It shows the positions of the six microphones, of the two advanced or observation posts and of the headquarters of the section.

The distances in metres that the microphones were, east and north of the origin of the survey of Egypt, are given by the numbers on the plan which are placed close to the respective microphone positions. The microphone positions were determined with the greatest possible precision and if a blunder were made in the location of one or more microphones, as frequently happened, it became apparent as soon as the sound ranging instruments were used.

No one was stationed at any microphone position, but at each advanced post there was always an observer on duty with a switch key in his hand. It was the duty of this observer to press the key whenever he heard an enemy gun and keep it pressed until he heard or saw the shell burst.

All information which could be obtained by seeing or hearing was telephoned at once to headquarters, either by the observer holding the switch or by one of his companions. Each microphone and observation post was connected to headquarters by means of two wires. By using the earth as a third conductor between headquarters and the advanced

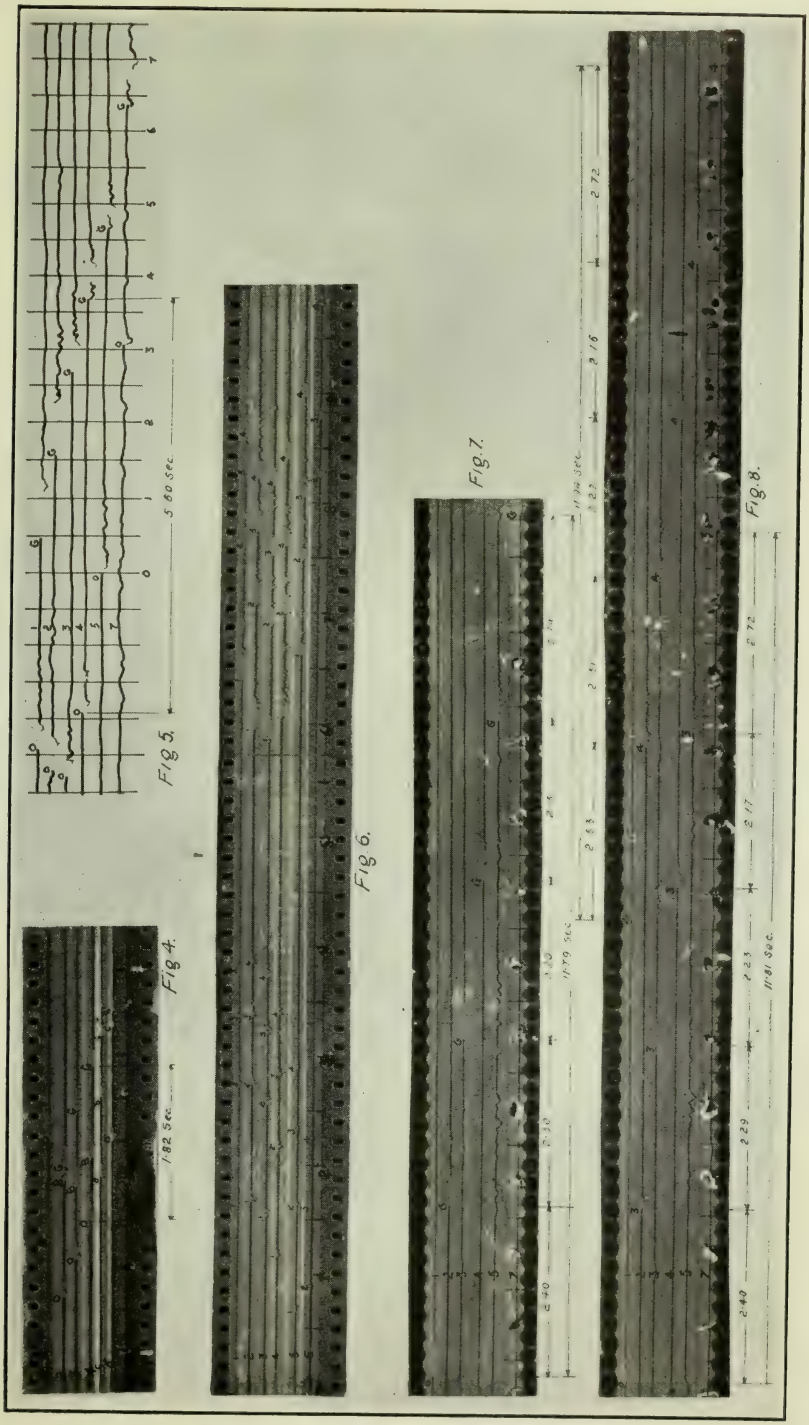


Fig. 4.
1·82 Sec.
Fig. 5.
5·00 Sec.
Fig. 6.
Fig. 7.
Fig. 8.

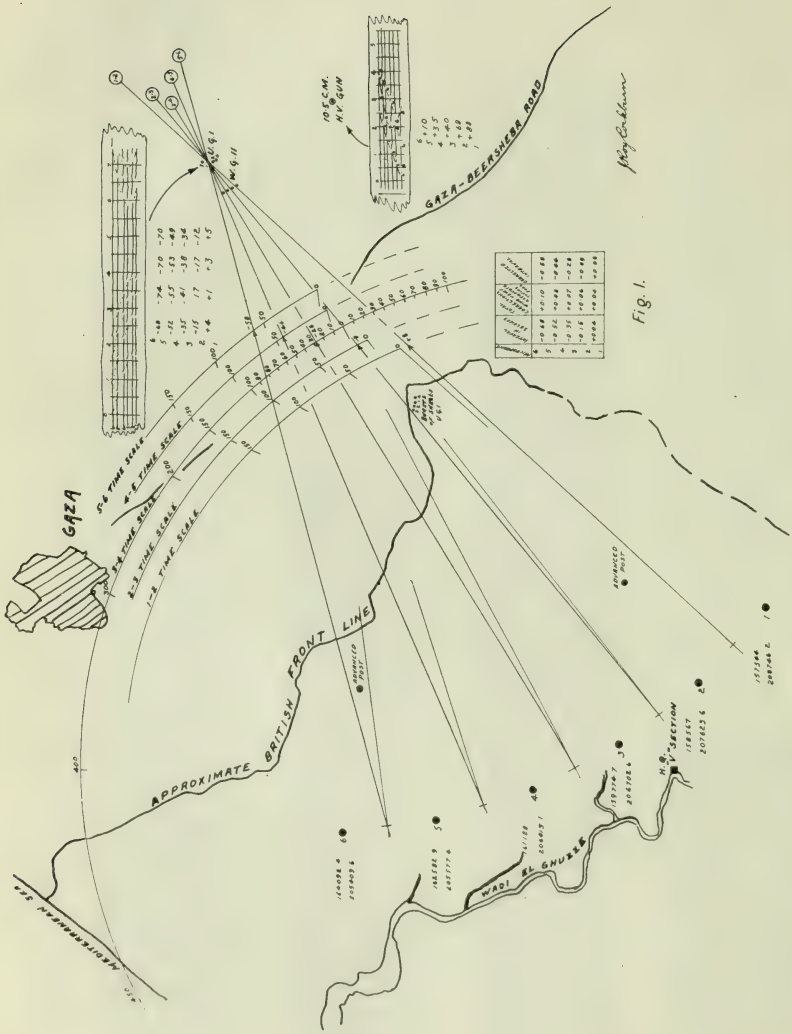



**Diagram Illustrating Computation of Hostile Battery Position from Film Record Reproduced in Fig. 6.**


Fig. 3

Diagram Showing Positions of H.Q. Microphones and Advanced Posts of "V" Section on the Sinjil Front.

posts, it was possible to operate the telephones with complete metallic circuits, and at the same time use the starting or relay switches in the hands of the observer without any mutual interference.

It was important that the telephone circuits should be independent of the earth, because the enemy was always ready to pick up our messages from telephone or telegraph lines.

In Fig. 1, the positions of two 15 centimetre German howitzer batteries, U. G. 1 and W. G. 11 and one 10.5 centimetre German high velocity gun are shown.

Fig. 2 is a reproduction of a film record used in locating the position of U. G. 1. It gives the necesary information to compute the positions of the four guns of the battery, all of which fired within the space of two seconds; also the positions of the bursts of the four shells, and, consequently, a fair idea of the calibre and type of the guns.

This film record indicates that the four guns are 15 centimetre howitzers, 1913 patterns, firing the sixth or largest charge.

Whenever sufficiently large pieces of enemy shells could be picked up, they were accurately measured and the information used to identify the guns. A few days before the III Battle of Gaza, U. G. 1 commenced firing on our front line. It was immediately located and one of our 6-inch howitzer batteries ranged on it. During the shoot W. G. 11 commenced firing with, as we judged, the intention of confusing our sound ranging records. The result was that we obtained a good record of W. G. 11, which proved to be exactly in line with V. G. 1 and our battery, and almost exactly 650 yards closer than V. G. 1. This enabled our battery to carry out a destructive shoot on both the hostile batteries. A few days later, after the Turk had been driven back, it was found on inspecting the ground that all eight gun pits had been heavily shelled and the ammunition scattered around and buried by our shells. The enemy guns had been removed. Fig. 3 is a film record of the 10.5 centimetre, high velocity gun indicated in Fig 1. The points marked "O" refer to the so-called "Onde de Choc" or "Shell Wave." This shell wave always occurs when the muzzle velocity of the shell is greater than the velocity of sound in the air. After the velocity of the shell has decreased to that of sound, this wave travels ahead of the shell and muzzle report, much as the waves from a vessel travel on ahead, when the speed of the vessel is reduced below that of the natural velocity of the waves in water.

The points marked "G" refer to the muzzle report of the gun and are the ones used in computing the gun's position.

The points marked "B" refer to the burst of the shell.

From the relation between "G" and "B," the time of flight of the shell can be computed.

Just before the Third Battle of Gaza, hostile batteries were plotted on the topographical maps from both aeroplane photographs and sound ranging reports; and it was discovered that, in a certain section, the two dis-

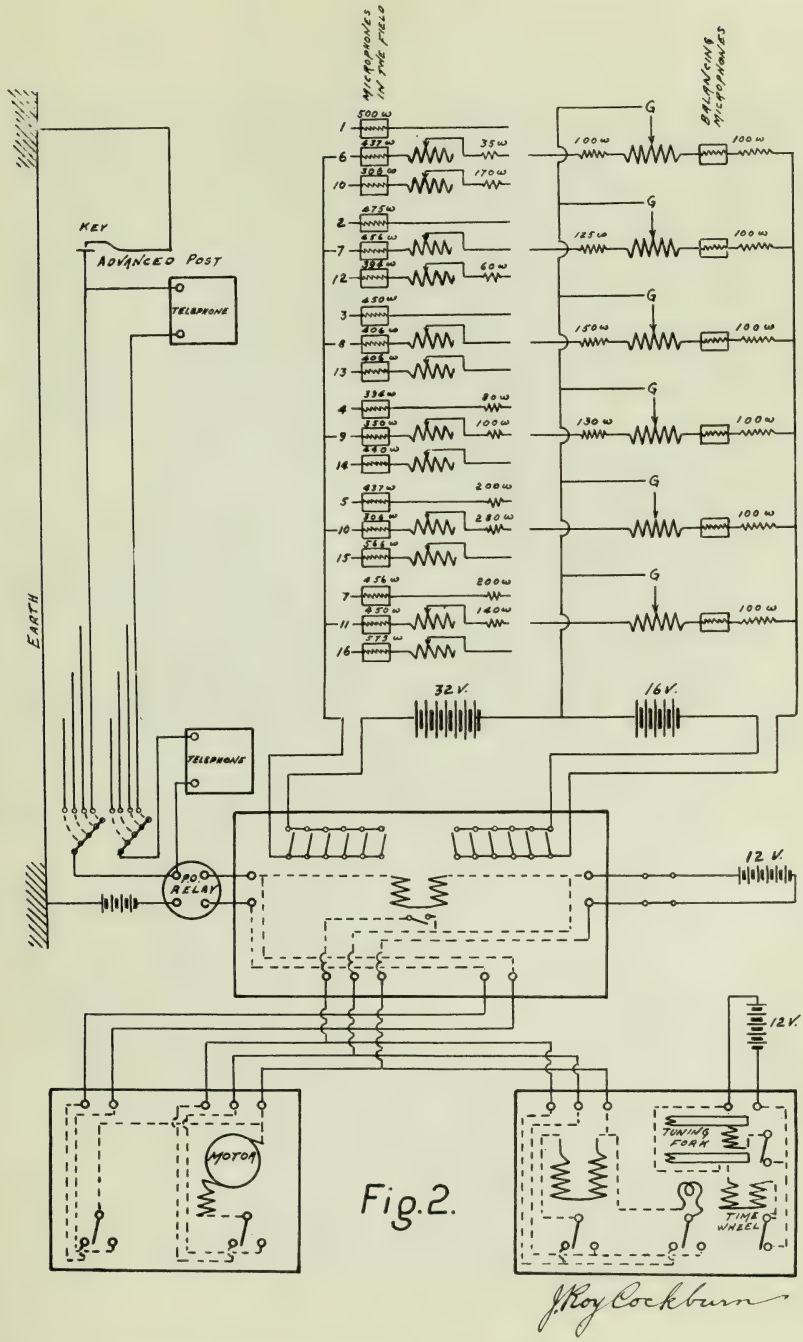



Diagram of Electric Circuits, "V" Section, Sinjil Front.

agreed fairly consistently to the extent of about 150 yards. This was taken at G. H. Q. to prove that the sound ranging records were inaccurate, to that extent; but "V" section resolutely maintained that it proved that the topographical detail was wrong. After the Turk was driven back, the ground was accurately surveyed and a new map issued, in which it was found that the discrepancy of 150 yards had almost entirely disappeared.

Fig. 3 illustrates the installation of "V" Section on the Singil Front during the summer of 1918—the only case in which one sound ranging section operated at the same time three sound ranging bases. The three bases were operated from a common headquarters and the efficiency was nearly as great as could have been obtained by operating each base from a separate headquarters. All of the special appliances needed for the three base installations, including nine of the microphones were designed and constructed in the field by the personnel of "V" Section.

As the recording instruments were originally constructed for use with a single base of six microphones, six only could be used at the same instant, but it was possible by moving a single handle to instantly change from any one of the three bases to any one of the others without upsetting the extremely delicate adjustment of the system.

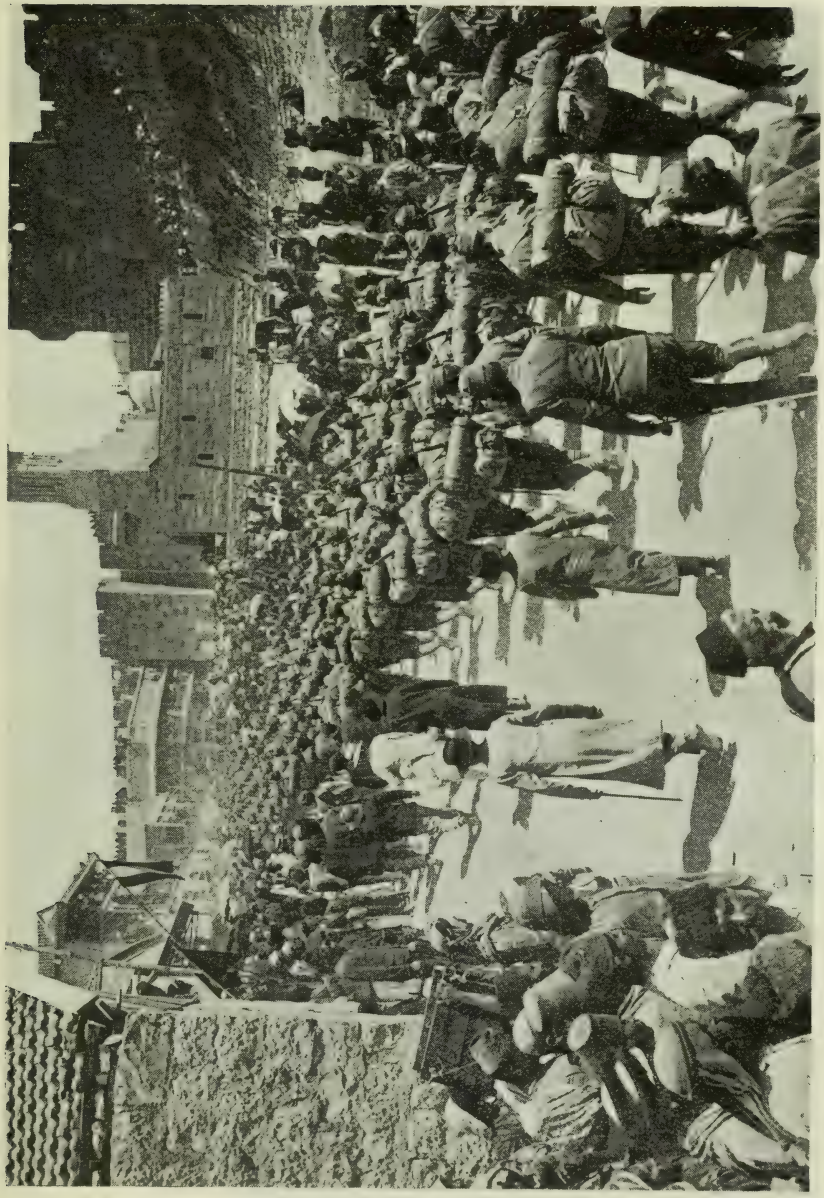
The points which are numbered are microphone positions. It might be noted that No. 7 did duty with both the right hand and centre bases, and No. 10 with both the centre and left hand bases.

The points marked A B C and D, indicate the positions of the forward or observation posts at each of which an observer was always on duty.

Fig. 2 is a diagram of the electric circuits of "V" section corresponding to the position shown in Fig. 3.

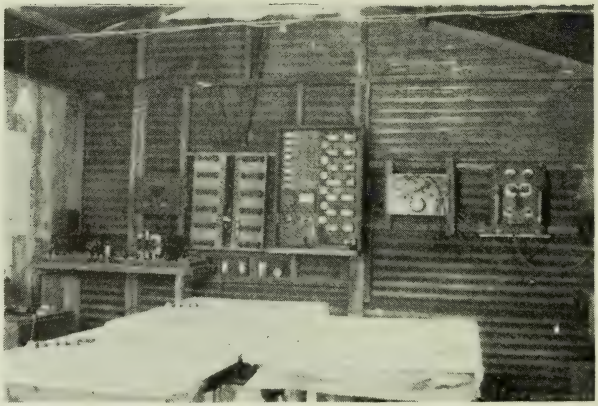
Instead of using the regular Wheatstone bridges for which the instruments were designed, the connections to the galvanometer were made as shown. This allowed two arms of each bridge to be eliminated, thus effecting a considerable saving in current consumption and adding to the sensitivity of the instruments. The balancing microphones shown in the diagram were first tried while on the Gaza-Beersheba Front. Their introduction resulted in the elimination of a very serious fault in the sound-ranging records.

A general idea of the actual operation of a sound ranging section can be given by describing the work of the Left Section of the 10th Heavy Battery and "V" Section in silencing "Jericho Jane," a 15.4 centimetre gun with a range of at least 20,500 yards, the longest range of any gun in Palestine.



Austrian Troops Marching Into Jerusalem. Tower of David in Right Hand Upper Corner and Jaffa Gate near the Centre.

H.Q.
"V" Section
at
Um Jerrar
between
Gaza and
Beersheba.



Recording
Instruments
and
Computing
Boards,
H.Q.
"V" Section.

Officer's Mess
"V" Section
in
Wadi el Jib.

Turkish Camel Corps at Beersheba.

On July 13th, 1918, at 9.20 p.m., this gun commenced firing on Jericho. Immediately the observer on duty at "A" post heard the report of this gun, he pressed his key, thereby closing the relay current. This switched the current on all the microphones of the right hand base. It excited the field of the Einthoven galvanometer which contained six platinum wires, one for each microphone circuit. It started the motor driving the moving picture film in the recording camera, and it turned on the fifty candle-power lamp which furnished the light for the photographic record.

The only part of the instruments kept constantly running was a timing device, driven by a synchronous motor, the speed of which was controlled by a tuning fork, making approximately fifty vibrations per second and interrupting the current supplied to the motor.

From the photographic record of the relative times at which the sound arrived at the six microphones, the time differences were obtained. The temperature of the air and the direction and velocity of the wind were observed and the necessary corrections applied to the time differences. A small correction was also made for the error of the tuning fork.

The velocity of sound in still air of average humidity at a temperature of 50°F is 369.1 yards per second. The time differences were therefore functions of the differences of the distances of the various microphones from the gun. For any one familiar with the properties of hyperbole and their asymptotes, the rest of the process is evident. The location of the gun was worked out graphically on a special computing board covered with a sheet of zinc, which was in turn covered with a sheet of drafting paper glued to it. Under ideal conditions the whole process from the firing of the gun to the finished location could be done in four minutes. On one occasion a computer at "V" section struggled with a very puzzling record, off and on, for twenty-four hours, with the result that he eventually obtained an extremely accurate location of a 15 centimetre howitzer, for which we were ready the next time it fired.

Instantly "Jericho Jane" was located, its position, (P32a0030) was reported to the Counter Battery Staff Officer of the XX Corps, who immediately assigned the left section of the 10th Heavy Battery (LX10HB in the diagram) to retaliate, no other British guns being within range.

The following is a record of the shooting of L X 10H.B.:

First shell from No. 3 gun—300 yards short, 150 yards right.

First shell from No. 4 gun—200 yards short, 50 yards right.

First group of three from No. 3—Range correct, 50 yards right.

First group of three from No. 4—100 yards short, 100 yards right.

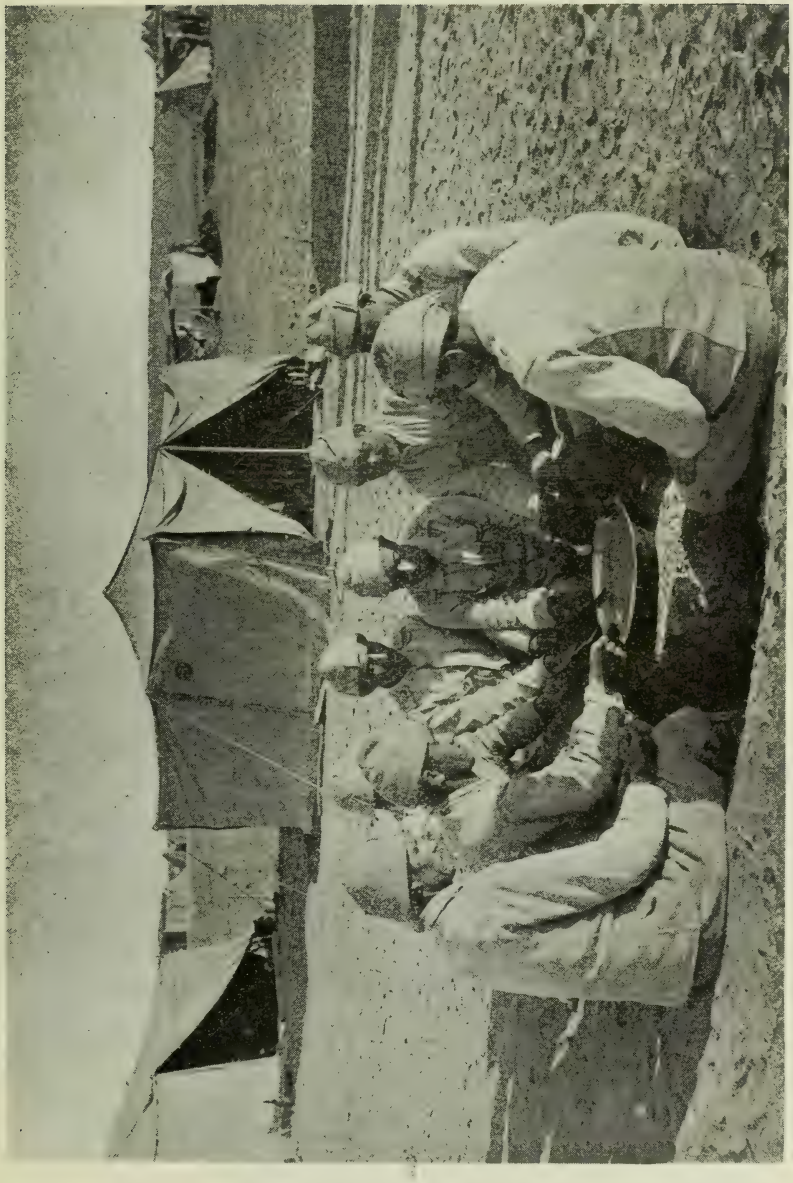
It was here noticed that the correction had been applied the wrong way to No. 4 gun, hence the 100 yards right.

Second group of three from No. 3—50 yards short, line correct.

Second group of three from No. 4—50 yards short, 50 yards left.

Third group of three from No. 3—70 yards short, line correct.

Third group of three from No. 4—O. K.



Turkish Troops Eating

15 4 c.m. H.V. Gun "Jericho Jane" in I.O.M.'s Yard at Jerusalem.

H.Q. "V" Section in Wadi el Jib.

"D" Post "V" Section.

Group of eight rounds from No. 3—O. K.

Group of eight rounds from No. 4—40 yards over, 20 yards right.

The left section of the 10th Heavy Battery fired in all sixty rounds; the last groups of three from No. 3 gun were O. K., and from No. 4 gun, range correct, 20 yards right.

During the firing of the groups of eight rounds which were registered by "V" section, "Jericho Jane's" ammunition was set on fire and the gun ceased firing.

"Jericho Jane" was only one of fourteen batteries located by "V" section between 8 a.m., July 13th, and 8 a.m., July 14th, and shoots were conducted on two of the others during that period.

In ranging our own guns on an active hostile battery, it was unnecessary to apply any corrections, because the errors would be the same for the location of the enemy gun and would, therefore, cancel each other; but in obtaining map locations of batteries or ranging our guns on batteries after they had ceased fire, we were very careful in applying corrections. One of the most unsatisfactory things about sound ranging was our inability to correctly observe the constantly changing wind and temperature in the hilly country.

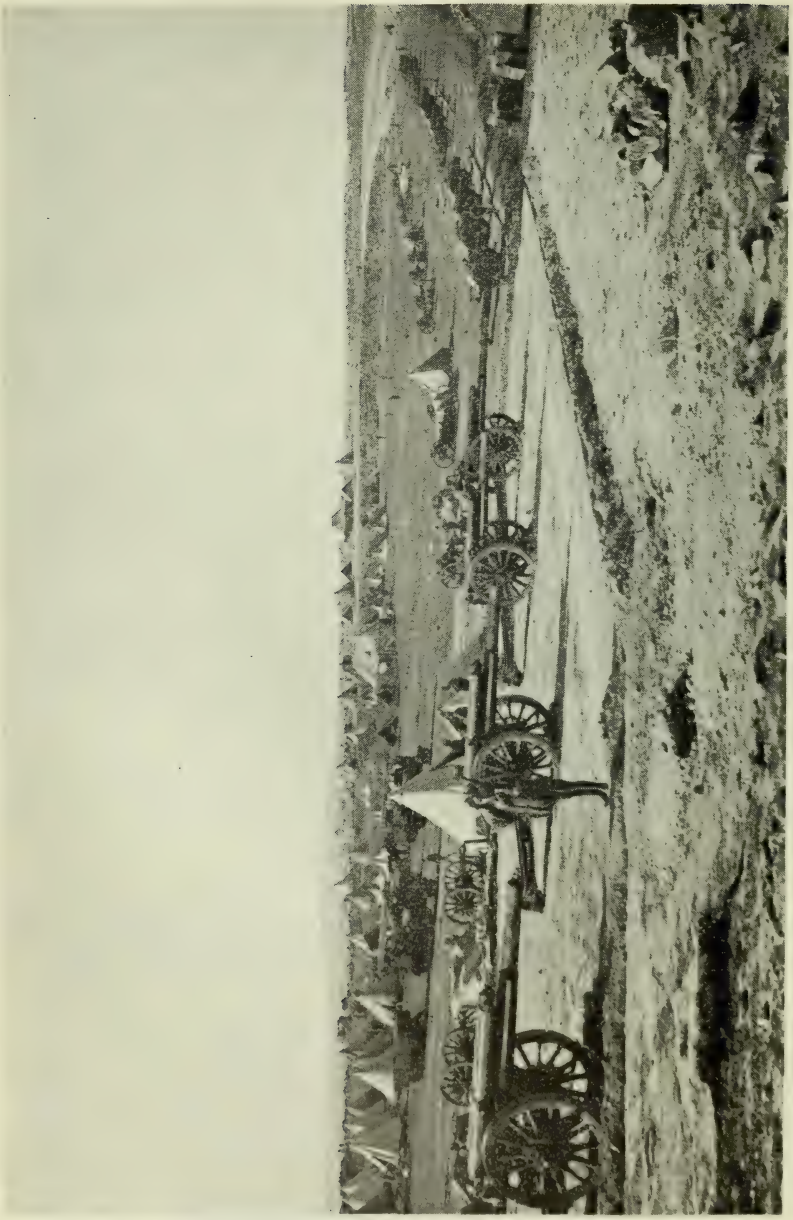
Fig. 7 is a film record of "Jericho Jane" firing at Jericho. As the line of fire was almost at right angles to the line joining the gun position to our nearest microphone, no shell wave was registered on any of the microphones.

Fig. 8 is a film record of the bursts of two shells from the 10th Heavy Battery. It shows No. 3 gun to be O. K. and No. 4 gun 40 yards over and 20 yards right of the target.

During the summer of 1918, 'V" section made a total of 1,106 locations, distributed over 167 hostile battery positions and also conducted 63 sound-ranging shoots involving the location of 1,515 rounds fired from our own guns.

Fig. 5 is a record of "Jericho Jane" firing almost directly over No. 4 microphone. It is clearly shown that the shell wave was 5.60 seconds in advance of the muzzle report. In Fig. 4 the corresponding interval for the 10.5 c.m. H. V. gun is shown to be 1.82 seconds and in Fig. 6 it is shown that no such interval exists in the case of the 15 c.m. howitzers.

Even should space permit, it would scarcely be advisable to give here a detailed description of the apparatus or of the fine points of sound ranging.



British Artillery in the Foreground. Jerusalem in the Background.

Both the enemy and ourselves employed the same mathematical principles, but the success of the British method depended upon the many refinements which were introduced from time to time. The most important and unique device used in sound ranging was invented by Mr. Tucker, an officer of the first British sound-ranging section. This device, although generally adopted, was guarded with great secrecy and the principle upon which it worked known only by those directly interested in sound ranging. The last time the writer saw Mr. Tucker, many months after the adoption of his invention, he was still wearing the single star of a Second Lieutenant in the Royal Engineers.

Each detail of sound ranging was worked out during the Great War and every progressive sound-ranging section was constantly experimenting and improving both the apparatus and method.

When the Turk was driven out of Jerusalem in December, 1917, by the British, he had intended taking the civilian population with him but his exit was so hurried that he even left behind Mr. C. Raad whom he had been employing as official photographer. The photographs of the Turkish troops which are here reproduced are a few of a set obtained from Mr. Raad. The small photographs were taken with a vest pocket kodak and developed at H. Q. "V" Section while in the field.

The ragged appearance of the sound-ranging records which are reproduced is due to the fact that only a few seconds were spent in developing them.

# CONFERENCE ON WATER POWER DEVELOPMENT

By Robert W. Angus, B.A.Sc.

The second conference on water power development was held from Feb. 19th to 27th, 1923, at the University. Like the former one, the one this year was arranged by the writer for the purpose of bringing before the students some of the engineers who are dealing with the practical affairs of life, and who, therefore, come with a freshness that is not possible to bring from inside the walls of the University. In addition to that these gentlemen are able to point out lines of procedure which have met with success, and to give an inspiration and enthusiasm for hydraulic work.

In every case great care was taken in securing the speakers, and all of them were invited as a result of my personal knowledge of their qualifications, so that there was not a speaker who did not bring a message well worth while. The speakers all hold positions of much responsibility and their names are well known in America.

Owing to the objects of the cause, as set before the speakers, the addresses proved of much value to practising engineers, and the interest taken by them was shown by the large number who attended the course.

The subjects for the addresses were selected with the idea of covering the entire field of water power development, although it was not possible to arrange the lectures in logical order, and therefore the course covered financial considerations, preliminary survey, stream gauging, turbines and governors, testing and operation, each being dealt with by a specialist in his own branch.

### Design of Water Power Plants as Affected by Financial Consideration

By J. L. Harper

The first address in the Conference was given by Mr. J. L. Harper, Chief Engineer and Vice-President of the Niagara Falls Power Co., Niagara Falls, N. Y. Mr. Harper is well known to engineers throughout America in connection with this company, and it is largely to his effort that the success of the company is due.

Mr. Harper proved a most interesting and entertaining, as well as a very witty speaker. In discussing the design of water power plants he laid great stress on the importance of building such works with a view to the best interests of the public service rather than that of undue economy, giving instances where extra outlay well repaid the expenditure, on account of the resulting improved efficiency.

The speaker emphasized the value of quiet thinking and said that he had got much of his education on the farm where he could develop his ideas undisturbed. He discussed many of the difficulties which greatly increase the cost of a water power plant, explaining that experience alone

teaches the engineer what he has to contend with. Mr. Harper pointed out that while people frequently speak of water as being free of cost for power, the same statement might also be made of coal, as both coal and water are free in a sense in the place where nature has produced them, but just as the cost of coal to the consumers is based largely on that required to take it from the mine and transport it to the place where it is used, so the cost of water used becomes large when one considers the amount of money and thought necessary to bring it to the turbines in an available form.

Some of the obstacles met with were discussed, such as the needs of navigation, danger from ice, and logging operations, and the speaker gave a curious instance in which a cemetery prevented the use of land for water storage and allowed only about half of the water power available to be used.

The lecture closed with a few slides of the new tunnel recently built in Niagara Falls.

### Preliminary Studies and Estimates for Water Power, and Moving Pictures of Some Leading Hydraulic Plants

By H. G. Acres

The speaker on this occasion, Mr. H. G. Acres, graduated from this University in 1903, and, with the exception of about a year, has engaged in hydro electric work ever since. He is chief hydraulic engineer of the Hydro Electric Power Commission and took a very active part in the construction of the Chippawa plant.

Mr. Acres' address had to do with the general preliminaries in connection with the layout of a water power plant, and he discussed quite fully the various factors entering into the selection of a site and the method of studying the effect of these different factors. He selected several different plants, put in by the Commission, as illustrations and showed how the scheme would be tentatively laid out from the general knowledge of the country and the capacity of the various streams.

After the preliminary idea is evolved, careful studies are made with regard to the flow in the stream, the fall available at different points in it, the variation of the flow at different seasons of the year and the possibility of marketing the power; and from these studies the final layout of the plant is made and then the detailed drawings are worked out.

In his second address Mr. Acres showed pictures of some of the Commission's plants, more especially that at Chippawa, and the illustrations proved to be particularly interesting in showing the detailed method of carrying out a job of that magnitude.

### Methods of Measuring Stream Flow and of Estimating the Available Water Supply

By C. C. Covert

This lecture was given by Mr. Covert, who has had an exceptional amount of experience on stream flow measurements, as he had been con-

nected for many years with the United States Government on the Water Supply Section of the Geological Survey, and he was therefore thoroughly conversant with the details of such work. At present Mr. Covert is with the W. & L. E. Gurley Co., for whom he is redesigning parts of their stream measuring apparatus.

The address proved to be of particular interest because Mr. Covert laid stress on serious errors that were likely to creep in in making measurements of stream flow, and pointed out that the actual measurement taken might represent very much more or very much less than the flow in the stream. In this connection he emphasized the need of selecting the measuring station at a point where one had some control of the stream, and said that an artificial control should be put in if a natural control was not available. That is, the gauging station would be put just above the rapids, over which there would be a definite depth of water, this depth being to a large extent a measure of the flow, and, if actual rapids were not available, he said that an artificial dam would be erected.

By this means the effect of back water would be avoided and this is very essential because back water means storage of flow which should be going over the dam.

The desirability of automatic water stage recorders was emphasized, as these keep track of the flow throughout the entire day, and, in certain illustrations, Mr. Covert showed that too few observations often led to serious inaccuracies owing to the varying nature of the flow in some streams.

The method of checking the measurements by plotting velocities, areas and discharges was also explained by Mr. Covert, and his whole address proved to be of particular interest.

### Modern Hydraulic Machinery, Turbines and Governors

By W. R. Keppler

This address was to have been given by Mr. D. J. McCormack, Chief Engineer of the Wellman-Seaver-Morgan Co., Cleveland, and a man who has had to do with the design of many of the largest turbines in use to-day. Unfortunately Mr. McCormack was delayed through illness, and so his place was taken by Mr. Keppler, of the same company, who proved to be an exceedingly good substitute.

Mr. Keppler sketched the advances made in modern turbine design from the earlier stages of about twenty years ago. He showed how the earlier plants had as many as six runners on a single shaft and how the twisting of the gate operating shafts gave such variable loads on the turbines as to cause much difficulty in control. He also discussed the various types of gate mechanisms, and explained the improvement which had been made in these recently, in the way of making the mechanism more reliable through placing the links outside, where they would not be subjected to the deteriorating effects of the water. Toward the end of the lecture Mr. Keppler discussed governing, and the making of the new type governor, showing various improvements which had been made and what these had

resulted in in the way of efficiency, and intended to go into a complete discussion of the remote control and the independent governor. Unfortunately the time proved altogether too short and it was a matter of regret that an extra hour was not available for the discussion of governing alone.

### The Testing of Hydraulic Turbines and Measurement of Efficiency

By Professor C. M. Allen

One of the most interesting lectures in the entire course was given by C. M. Allen, Professor of Hydraulic Engineering at Worcester Polytechnic Institute, and a consulting engineer with a very extensive practice, mainly in turbine testing and the development and improvement in their setting.

The methods of testing used by Professor Allen proved to be quite new to most of the audience, as he has not been using the electric generator for producing the load and calculating the turbine output from measurements on the generator, but wherever the turbines have been tested he has removed the generator or pulp grinder or whatever load was there and substituted for it an Alden dynamometer. The development of these dynamometers has been made by Professor Allen in conjunction with George I. Alden and they have brought the apparatus to a very good state of perfection, so much so that they are able to apply them to turbines of quite large powers.

When the turbine is to be tested, Professor Allen selects a dynamometer from his stock and ships it to the place where it is to be used, then attaches it to the machine in place, which often requires a good deal of special setting. Slides explained by the speaker showed him to be a very resourceful man indeed in the way of erecting his apparatus, with very little equipment, and his method of getting the zero loads of the dynamometers with all the equipment in place, were very nicely presented.

The second part of this lecture dealt with the method recently devised by Professor Allen for the measurement of the quantity of water flowing to a turbine, his method consisting of placing in the pipe a penstock, at two different points, a pair of insulated terminals to which 110 volts is applied, and an ammeter in the same circuit shows the current flowing, which will of course be very small owing to the small conductivity of the water. When a measurement is to be made, a quantity of salt is injected into the pipe above the first pair of terminals and the time that it passes under the terminals is indicated by a marked increase in the conductivity of the water, so that by noting the readings of the ammeters at the two points the exact time of flow of this salt solution is easily determined, and from it a very simple calculation gives the mean velocity in the pipe.

The method has met with a great deal of success and the speaker said that his results had given an error much less than one per cent. as compared with volumetric measurements in a tank. It is particularly gratifying

that this method was described at this lecture, for the second time only, in public, and we were, therefore, fortunate in having Professor Allen address the meeting.

The last speaker in the course was Mr. Don Carlos, who is head of the operating department of the Hydro Electric Power Commission, and has had to do with the operating of their plants for a number of years, proved very successful in his work. He is a graduate of the University of Missouri. This lecture is printed in detail elsewhere.

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# OPERATION OF WATER POWER PLANTS

Mr. H. C. Don Carlos, Hydro-Electric Power Commission

Address delivered at Water Power Development Conference at the University, Feb. 27, 1923.

Professor Angus has referred to me as a practically trained man. This does not occur to me as being any particular distinction. Any engineer must be a practically trained man. The greater part of all our engineering training and education is obtained outside of what is usually termed our engineering course.

Your degree and diploma is conferred upon you when you have completed the prescribed course in the University, but your real engineering education is obtained outside the University. Most of you, when you have obtained your diplomas, will take them home and put them away in your trunks and forget all about them. I have a diploma some place around the house from the Missouri State University, but I don't even know where it is.

I don't want any of you to misunderstand me as speaking lightly or disparagingly of your University course or the importance of studying hard and doing good work. Your University course is of great importance as a foundation for your engineering training. But don't get the idea that when you have completed your University course, and obtained your degree and diploma, that you are an engineer—you are just ready then to start your real engineering training.

Those of you who expect to follow engineering should get out and learn to do things by doing them yourself.

At this point I should like to draw attention to the value of engineering experience which it is possible to obtain from being directly in touch with the operation and maintenance of mechanical, hydraulic and electrical equipment in service. In my opinion there is no place in the world where a man can get a more valuable experience to fit him for design work, than that of being in direct touch with the performance of equipment in service. Such experience is also of value in educating a man to the importance of layout and is also invaluable to him when he may be called upon to select equipment for any given service. I have noticed that there seems to be

an aversion on the part of young graduates to go into this class of work. They seem to prefer the drafting room or office or shop. Shop experience is no doubt of great value but I maintain that a man should have actual operating experience before qualifying as a designing engineer for either equipment or layout.

Don't expect, as soon as you get out of school, to go out and get an engineering position, go out and get a *job*. My first job when I had finished my course in electrical engineering was digging post holes and, having had previous experience at farming, which has to do with the soil, I did fairly well at the job of post hole digging. Then I learned to climb poles, (the linemen called it hiking), and I think probably I was as great a success at this as Mr. Harper was at cleaning horse manure off of street car motors. I think I was considered a first class lineman at one time. At any rate I could handle myself as well on a pole and do as much line work as any of the men I came in contact with. This experience has, I consider, been of considerable value to me.

I learned the blacksmith trade before I went to the University, and during my University course I would go out and work at blacksmithing during the summer vacation. This experience has also been of value to me. Within the last two years we had occasion to do certain repair work on a section of wood stave pipe line at one of the plants. This necessitated a complete shut down of the plant and, of course, we took advantage of the most opportune time which was over a Sunday and holiday, which came consecutively. During the course of the work some special tools were required and as there was no blacksmith available I had to turn in and make the tools myself, which I was able to do on account of my previous experience in this class of work.

The H. E. P. C. at present own and operate 19 hydro-electric and two steam generating stations, which are supplying power through a large number of transforming stations and about 3,200 circuit miles of transmission lines throughout the Province of Ontario.

It is the primary duty of the operating staff to deliver power from these plants and over the transmission and transforming systems, as demanded up to the capacity of the plant, also to maintain the plant in such condition that it will be capable of delivering power when required. This necessitates maintaining a considerable staff with a great diversity of qualifications capable of performing from the simplest operations such as handling an oil can and cleaning machinery to such complicated problems as completely dismantling and rebuilding turbines, generators, governors, transformers, etc., and making studies of water and ice conditions.

In case a piece of equipment of any kind breaks down in service, or fails to properly perform the function for which it was intended, the reason for the failure and the accompanying conditions, must be carefully studied, and in making repairs the weaknesses or defects must be eliminated if possible, and any objectionable conditions removed.

It follows, therefore, that while the design and construction of the plants do not come strictly within the duties of the operating department, there are many features in the design and construction regarding which they should be consulted.

### Simplicity and Accessibility

Two of the most important features in any type of equipment from the operating standpoint are simplicity and accessibility.

These can be sacrificed to some extent where necessary to get the highest efficiency in large main turbines in a plant, but in the case of the auxiliary or service units, on the continuous operation of which the whole of the output of the plant depends, simplicity and accessibility for examination, adjustment and repairs should be one of the principal considerations in the design. The actual output from such machines is only a small percentage of the total output from the plant and a slight loss in the efficiency of these small machines would not be noticed in the total output, while an excessive time to make repairs may interfere with the output from the whole plant. Horizontal units are, in my opinion, more desirable from this standpoint for service units than vertical units.

### Erosion

Erosion is probably caused by air freed from the water when passing through the turbine, due to sudden changes in pressure. This air may contain an excess of ozone or oxygen in a nascent condition, and has a very marked effect on iron and steel, and to a lesser extent on bronze. Pitting, or a sort of honeycombed condition of the surface, is produced and when once started is cumulative, due to the destruction of the smooth surfaces of the vanes. In some cases large cavities have been eaten out of the runner vanes in a very short time.

Owing to the development, in recent years, of electric welding, this is not such a serious matter as formerly. Turbine runners of bronze, steel or cast iron can now be successfully repaired by electric welding. This has practically revolutionized turbine maintenance. We have successfully built up bronze runners, which five or six years ago would have been consigned to the scrap heap. We have built up worn bronze wearing rings and have repaired broken runner vanes in place. The possibilities of this process are so far reaching that they deserve the immediate attention of every power plant management.

### Valves

The valves used to cut off the water from the individual turbines or penstocks require periodic inspection, and, depending on the type of valves used, may, after long periods of operation, require extensive repairs and renewals.

Three main types of valves are used for this purpose, ordinary gate valves, butterfly valves and Johnson valves. Butterfly valves and Johnson valves are more suitable for high pressures and large sizes due to the difficulty of operating large gate valves under high head. While butterfly valves are much cheaper than Johnson valves, they are much more diffi-

cult to make watertight. Neither of these types require much attention aside from regular operation at intervals of three or four weeks, to prevent rust and silt accumulations from making them stick. The Johnson valves, however, being hydraulically operated and controlled from penstock pressure, we have found it advisable, where there is a great deal of ice liable to be present in the water, to have a second source of water pressure available for their operation.

The large gate valves at the O. P. plant are operated by electric motors and are quite reliable within their limits until the screws and nuts become badly worn. We found in the case of some of these valves that after eight or ten years operation, the screws and nuts had worn so badly that the valves were likely to become inoperative. They were of the stationary stem type with the screws turning through nuts fastened in the gate, which moves to and fro as the screws are rotated by gearing. The screws and nuts being under water, and inaccessible for lubrication, became covered with rust and dirt which gradually ground away the threads. It would be a comparatively simple matter to repair these if the pipe line above the valves could be unwatered whenever work was to be done, but since this was impossible the problem was one which required some study and much hard work for its solution. Without burdening you with details, I may say that we have successfully replaced the screws and nuts in practically all of these valves without losing the service of a unit at any time when required for load. At the same time, the design of six of these valves was changed to the rising stem type with outside nuts operated by gears, an arrangement which we are confident will avoid trouble with screws and nuts wearing out so rapidly in the future.

### Lubrication

Of course a continuous supply of oil must be provided for all the bearings, and in large size bearings where any considerable amount of heat is generated, it is necesary to dissipate a part of this heat by cooling the oil. This is done either by water cooling coils in the bearing or by pumping the oil through a cooling system or both. In horizontal machines it is often the practice to provide a large oil reservoir under the bearing with cooling coils, then the oil is carried up into the bearings by oil rings. In this case the oil is not circulated outside the bearings. It is self-contained and requires very little attention. Other than this there are two main systems in general use.

(1) Gravity system.—In this system the storage tank is placed at a considerable height, depending on the oil pressure required, and the oil is fed from the storage tank direct to the bearings, then it drains away to a sump tank and is pumped back to the storage tank after being filtered. The gravity system has a great deal in its favour; it provides uniform pressure which is very important in regulating the supply of oil to the different bearings, and the reserve supply is limited only by the size of tank which it is desired to provide. Pumps of almost any type and intermittent in

their action can be used without affecting the supply of oil to the bearings.

(2) Pressure system.—This system is used when pressures are too high for a gravity system or where there is a lack of room, and sometimes for cheapness. It is, however, necessary to have a storage tank in the upper part of which is an air cushion. The oil is discharged into this tank by the pumps before being delivered to the bearings. Without this intermediate pneumatic storage tank, the oil will be delivered spasmodically, depending on the pulsations of the pump, producing vibrations in the whole oiling system, and in addition a large amount of air will be entrained in the oil, which will expand on delivery to the bearing, forming an oil spray which will be carried away by air currents from the rotating machines.

This is especially objectionable in generators as the lubricating oil causes the insulation to deteriorate and dirt collects, clogging up the ventilating ducts, making frequent cleaning both necessary and difficult.

As to the grade of oil to be used in any particular case, it is usually found that the lightest oil that will serve the purpose is the best one, as it will carry away the heat better and the flow is easier to regulate.

Considerable notice has been taken recently of a certain germ treatment for lubricating oils. We have tried this treatment to some extent with rather indifferent success. It is my opinion that there is a wide field for development both in lubricating oils and in methods of lubrication.

### Bearings

The building of vertical shaft turbines and generators in increasingly large sizes has necessitated the development of thrust bearings to carry these heavy rotating parts. The large vertical units built ten or twelve years ago were all equipped with high pressure oil thrust bearings. These necessitated very high pressure oil pumps and a great amount of auxiliary equipment which always gave considerable trouble and was expensive to maintain. In recent years there have been three main types of thrust bearings developed, which are in general use, all of which are giving very good results. The Kingsbury, the Gibbs and the General Electric spring bearing. The principle of operation of all of these is the same, but has been worked out along slightly different lines. These thrust bearings give very little trouble in operation. In fact they probably give less trouble than the guide bearings. The principal trouble with the water lubricated lignum-vitae guide bearings used in turbines is in getting a supply of water for lubrication that is free from sand and grit.

Careful balancing of the rotating parts contributes a great deal to the successful operation of guide bearings.

### Governors

Turbine governors are among the most reliable and at the same time most misunderstood pieces of equipment in a power plant. Governors if of modern and proper design will regulate speed with a high degree of precision, with load variations usually encountered in supplying the average commercial power, and with a reliability that is exceptional. Their main

function is, of course, to maintain speed within permissible limits under the varying load conditions, by adjusting the gate opening in the turbines to suit the load requirements. It is impracticable to maintain absolutely constant speed under all conditions, and the governors in any individual plant must be adjusted to suit the conditions encountered in that plant, striking a suitable balance between permissible speed variations and pressure rises in the penstock and wheel cases. The flywheel effect or inertia of the system will, of course, assist the governors in taking care of momentary load fluctuations and tend to maintain constant speed throughout the changes, (in other words the inertia of the system tends to resist any sudden changes in speed).

The governors of the individual machines in any plant or in different plants, if operating in parallel, must be capable of adjustment so that the machines will take their proportional part of the load variations. Or in case it is desired for any reason to have one machine or a group of machines operate on base load, (or constant load) and allow the other machines to take the variations, then the governors must permit of the proper adjustments being made to meet this condition of operation.

The cost of maintaining governors is usually very low if of proper design. The moving parts must be kept clean and well lubricated and when once wear has exceeded a few thousandths of an inch on the valves, they must be repaired, if the governor is to function properly. Deferred maintenance on governors results in unreliability and increased wear and tear on the pumping plant supplying the pressure medium, and in poor speed regulation, and may present a very serious hazard to the plant.

Older types of governors operated on a closed system with a pressure on one side of the pump and a vacuum on the other side. This system required a special oil that would not break down under the vacuum. This special oil is expensive and requires to be renewed at frequent intervals, resulting in high operating costs. Manufacturers of modern governors have abandoned the closed system for the open system, and we are at the present time changing over some of the older governors at the O. P. plant from the closed to the open system.

Both oil and water are used as governor fluid, and if the open system is employed the ordinary lubricating oil generally used for bearing lubrication gives good results. If water is used, it must be treated in some way to prevent corrosion. This is usually accomplished by the use of emulsified oil or potassium-bichromate, or some other treatments which render the water non-corrosive. The governor fluid must, of course, be kept free of solid matter, such as dirt and sand, and it is, therefore, necessary to employ filters if water is used.

One of the principal advantages in using water is that it permits the use of centrifugal or turbine pumps, which have lower maintenance cost and longer life than plunger or gear pumps. Centrifugal pumps are not developed to the point where they are generally used for pumping oil at the

high pressures used on governor systems (usually from 150 to 225 lb.). Water is also considerably cheaper than oil.

Both central pumping plants and individual pumps for each governor are employed. In plants having a large number of units, I personally favor the central pumping plant with sufficient spare equipment installed and with automatic features for starting up additional units in case of the failure of one, or the overloading of those in operation.

The central pumping plant tends to cut down the maintenance cost and is more reliable, as there is less liability of losing the pressure in any individual governor which may result in a run-away or poor speed regulation. In the case of a two or three unit plant it is advisable to install individual pumps of sufficient capacity to carry the entire plant and have them all pump into a common pressure header.

### Ice Troubles

In severe winter weather ice in one form or another often presents a very serious problem. We have three different formations of ice to contend with in the Niagara River, hard block ice, frazil or slush ice and anchor ice. The hard block ice forms along the river and lake shore in sheltered spots, and when broken up by shifting winds is carried down the river. This form of ice probably causes more trouble in the operation of plants at Niagara than any other form of ice. In exceedingly cold weather, we often have the block ice and frazil to contend with at the same time; in these cases considerable trouble is experienced. The frazil will collect on the ice diverters and along with the block ice forms a solid mass which tends to clog up the water passages. The only effective way to deal with this trouble is by the use of dynamite. From two to six sticks of dynamite placed in a bag of sand and sunk to the proper depth seem to be quite effective. We have never found that permanent structures were damaged by the proper use of high explosives in this way.

Anchor ice forms usually at night in very cold weather on the bottom of the river, then during the day when the sun comes out, it rises from the bottom carrying with it rocks and other rubbish from the river bottom; being thus weighted, it floats low in the water, goes through under the diverters and finds its way into the turbines where it does more or less damage.

During the winter, conditions in the Niagara River make it necessary for all the older plants to operate with the trash racks removed, (we expect that this will not be necessary at the Queenston Plant). With a slush ice, this is not a serious matter, but when hard block ice and anchor ice carrying stones and rubbish gets into the wheels, all sorts of difficulties are to be expected. Most turbines are provided with breaking links so that in case ice or other material jams in the gates and the governors move the gate mechanism, the gates jammed will be freed by the breaking of the links. These breaking links, however, are not always

reliable, and in one case we had a turbine suddenly jam with ice and by a movement of the gates break seventeen out of twenty gate arms besides breaking the links.

In another case two gate links broke, one of the gates turned completely over and wedging with ice and stones acted as a tool would in a large lathe and trimmed off about four or five inches of the runner vanes all round the wheel. The 2½″ solid steel gate shaft was sheared off close to the gate. This turbine was put back into service after replacing the broken gate and cutting off the bent-over vanes, and operated satisfactorily with only a slight decrease in capacity.

Ice trouble in the Otonabee and Trent rivers consists almost entirely of frazil, and I believe that practically all the plants operating on these rivers are affected to a more or less extent at times by this form of ice trouble. This usually occurs early in the winter before the river freezes over and on the occasion of a sudden drop in temperature. The trouble usually disappears after a continued cold spell has caused the different reaches to freeze over.

Different methods of combating this form of ice trouble have been tried out with varying success, such as heating the racks and mechanical rakes, but we have found that in most cases with turbines having comparatively large openings and the wheel settings designed in such a way that the wheel cases can be kept at a slightly higher temperature than the freezing point, serious trouble can usually be averted by watching conditions carefully and pulling the racks before the frazil is running to such an extent as to block them up and shut off the flow of water.

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# THE ENGINEER IN RELATION TO THE PROBLEM OF FIRE WASTE

By E. P. Heaton, Fire Marshal of Ontario

Before throwing on the screen the slides with which I purpose to illustrate this address, let me define the terms used in the title.

By "Engineering" you will understand even better than I, the application of the term may be very broad, covering professional advice in various specialized directions, as, for example the "Sanitary Engineer," "The Power Engineer" (covering light, heat and power), "The Mechanical Engineer" (covering also electrical conditions), and others that you will readily think of, but I use the term in its generic sense, and interpret it to apply to one who plans or superintends the construction and equipment of buildings to meet the requirements of our modern, complex civilization.

Before I conclude it is possible you may have a vision of an opening for another class, I mean the "Fire Prevention Engineer," for I believe there is a field in such a professional capacity that can be wisely and profitably exercised. As a matter of fact, I am glad that we have in associa-

tion with our office a past president of your Society, and a recent graduate, who are rendering excellent service in the direction in which a Fire Prevention Engineer might profitably use his knowledge and experience.

"Fire Waste" is a subject that has been brought to your attention in your various sections through literature and instruction, and I am not going to waste your time by any extended reference to its enormity, or to its clauses. As a matter of fact, the recent graduate from your Society became associated with us because he was the prize winner in the competition conducted under the auspices of our own office. Suffice it in a word to say that we expect the year 1922 to be the worst one the province has ever experienced in regard to its inexcusable loss by fire, apart altogether from the waste in our natural resources, in the bush, and in the forest. Probably we shall reach the extraordinary total of twenty-two million dollars as the year's fire waste, and it is in consideration of the engineer's relation to that fire waste that I want to say a few words.

The "Problem" centres around two distinct features. Our statistics show that out of about 10,000 fires in the province, costing, as I have said, some twenty-two million dollars, about one hundred fires are directly responsible for one half of the sum total of all the losses. In other words, the big fire carries its own problem.

The second feature is found in the commonly-called "Exposure Fire." In normal years we generally understand that from 15 to 20% of the aggregate fire waste arises from fires in neighboring buildings, or from outside exposures. Owing to the conflagration in Northern Ontario of Oct. 4th, the year 1922 will be specially marked because the ratio of the exposure fires for that year will be between 45 and 50 per cent. We must, however, for obvious reasons, eliminate the Northern Ontario conflagration from consideration and revert to the common experience that about one-fifth of the loss is due to some exposure.

It is with particular regard to the latter feature that I want to throw some slides upon the screen to illustrate and enforce the engineers' relation to a particular feature that will there be brought out, and I will reserve further comment upon the subject until the slides are presented. I may, however, very frankly and candidly admit that the fire waste problem in its broadest sense, and in its restricted application to the exposure fire, can only be solved by the engineer, and to him is not only given the necessity but the opportunity for attacking it and overcoming it. The history of the engineers' work in relation to Fire Prevention is so romantic that I could occupy much longer time than I have at my disposal in picturing it to you, and yet I must briefly bring it to your attention. Some 75 or 80 years ago the cotton mills of New England were burning so frequently that fire insurance upon that class of risk was exceedingly difficult to obtain, and when obtained the high rate charged because of the hazard almost made it prohibitive, consequently the mill owners associated themselves together for the purpose of endeavoring to determine why fires were so frequent, and

how they should be met. It was readily ascertained that very many of the fires came from the picker and carding machines, and at once the engineer's answer was, that being the case, we will segregate these hazards, and put them in separate buildings where, when fire does ensue, the rest of the property will not be endangered, and the fire loss will be comparatively light; and one fundamental requirement to-day of all cotton mills is the isolation of the picker house, and the protection at all events of the carding machines.

At this point Mr. Heaton related Charles Lamb's inimitable and satirical essay in "Roast Pig" and used it as an illustration that may possibly have been drawn from the occurrence of the uniting of the New England cotton mill men to meet the special conditions that were arising in their business. From the gathering together of the mill owners there arose the organization of what is known to-day as the New England Mutual Insurance Companies, the basis of which is engineering service to prevent fires, and Mr. Heaton spoke of their marvellous record and development, featuring the introduction and perfecting of protection by the automatic sprinkler. To demonstrate the efficacy that the automatic sprinkler had reached, there were three distinct periods in the general practice of the insurance companies, the first period running from 1850 to 1875 when automatic sprinklers had just been introduced, but when few installations had been made. In that period of 25 years the loss by fire to the insurance carried was .25c per $100. The next period was from 1876 to 1895 when the automatic sprinkler was becoming more generally recognized, and where many installations were being made. In that period, with four times the amount of insurance at risk the fire loss was less than three times the amount in the preceding period, and the average cost was 18c per $100. The third period was from 1896 to 1921 during which period the senior Mutual Insurance Companies had made a rule of complete and thorough protection of all buildings by the automatic sprinkler. In that period with six times the amount of insurance in force, or, as I may say, six times the liability, the fire loss was just one-third more than it was in the previous period, and the average cost reduced to .04c per $100, a marvellous showing, considering that in that period the amount of insurance was nearly ten billion dollars, due entirely to the work of the Automatic Sprinkler Engineer.

I would like to trace for you the origin and development of the N.F.P.A., who last year celebrated their 25th anniversary, an association of engineers who have throughout given their time, voluntarily, to the preparation of proper standards of engineering in building construction, and in the use of mechanical appliances, and if I had time to dwell upon the intensely interesting history of this Association, it would, I am sure, appeal to you as placing a halo of glory on the heads of the men who have so faithfully, without remuneration, and unstintingly given their time to the work.

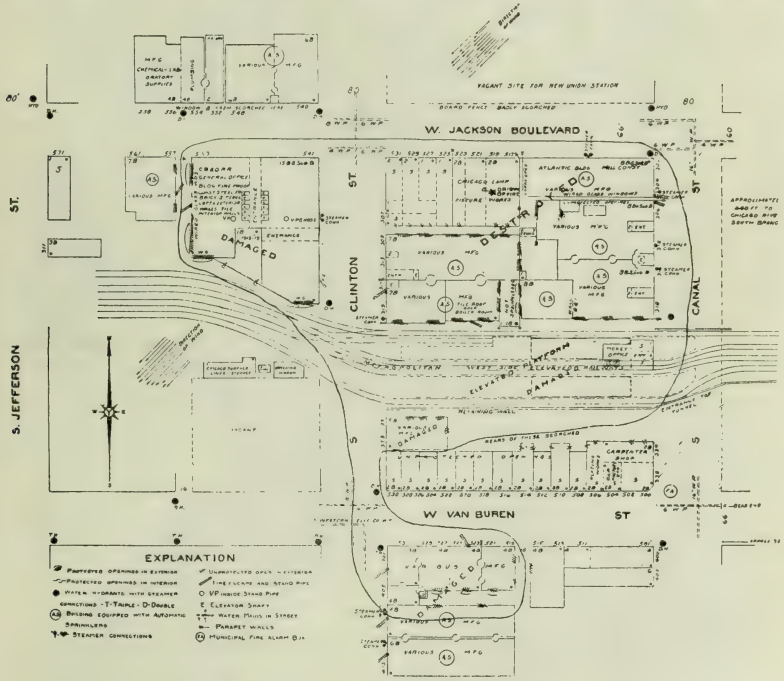
I think I may state a truism that you will all accept when I say that the scientific achievements of the last half century have been remarkable in extent and in their benefit to the people, and yet, it is equally true, that in nearly every case the achievement has produced a corresponding fire hazard. Take for example the prevalent use of electricity for light, heat and power, and you all know what hazards have necessarily been met with in the processes and in present day usage. Take again the very common use of the automobile and the motor car with its necessary corollary, in the use of the highly explosive and volatile substance of gasoline. So I might go on and quote other instances, but these are enough to illustrate the statement I have made and also to justify the further statement that the engineer has controlled and safeguarded the hazards as they have been met

Chicago Fire—March 15, 1922

with, one by one, until it may be fairly said that the involved hazards have been brought into subjection and control, and the fire hazard reduced to a minimum, if not practically eliminated.

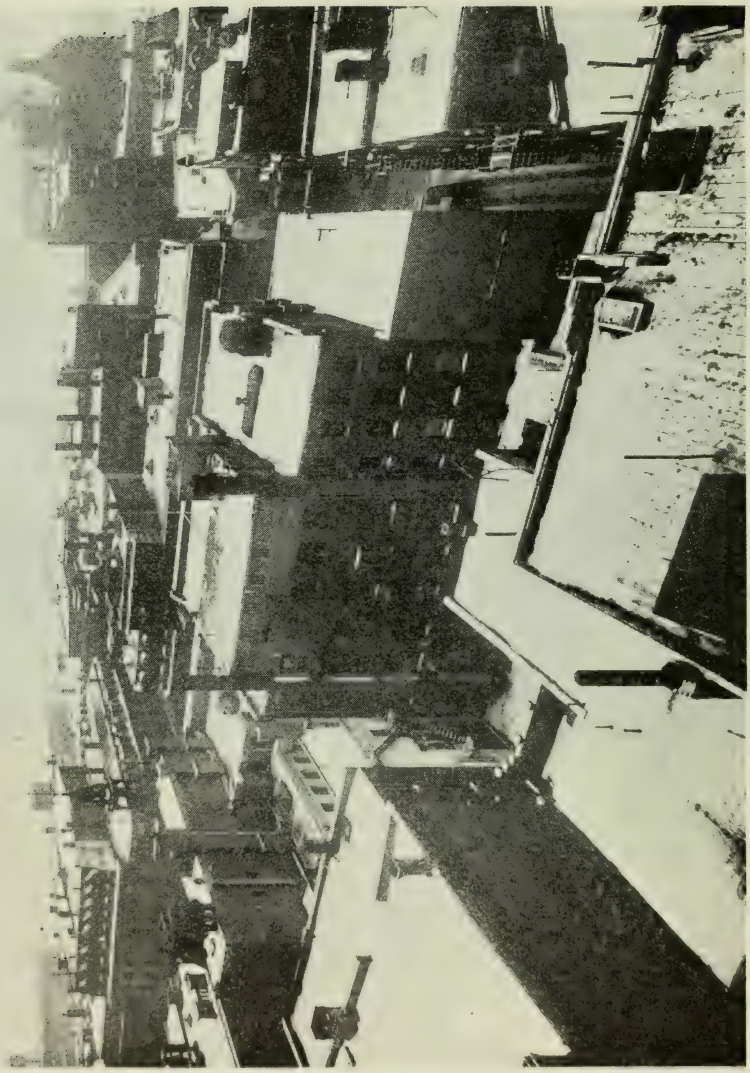
Reverting for a moment to the definitions with which I started, the big fire necessarily arises because of the big plant. These are days of concentration of values, of combination of forces when under one roof must be gathered enormous values. Again, the concentration of population in our urban centres and the enormous increase in land values has necessitated building in the air, and we have the skyscraper. In the course of the last 50 years engineering skill has practically produced the skyscraper, safeguarded in construction and protection to the highest degree, and if on March 14th, 1922, I had asked if a fireproof building had been designed and erected, the answer would have been, "Yes, many of them," and if I had gone to Chicago and looked at the office building of the Chicago,

Burlington and Quincy Railroad, and had asked if that could be taken as a typical illustration, the answer again would have been, "Yes," for if there was one building in Chicago, which, by reason of its construcion and occupation was regarded as a fireproof building, that one was so regarded, but on the 15th March, 1922, the belief had been shattered, for on the early morning of that day this particular building was practically destroyed by fire, at all events, from the 8th storey up, at a loss of considerably over one million dollars, and I now purpose throwing on the screen some pictures taken before, during, and after this fire, that they may bring home to us the fact that we have not yet devised an absolute fireproof building, and that we shall not do so until the control of the fire from without, (the exposure fire) has been brought much nearer to perfection than it now is. In this fire twelve buildings were destroyed with a loss of from five to eight million dollars; seven were of four storeys or less; one was of seven storeys in height; three of eight storeys in height, and one, the particular building already alluded to, the Burlington Building, of fifteen storeys.




**Burned Area—Chicago Fire.**

Reference to the following diagram will show the area of the fire in question. Nothing is particularly asked to the fact that the Burlington Building, shown on the west side of Clinton Street, fronts on a street 80 ft. wide, and the marvel is, how the fire crossed that street. We can understand how the fire spread from the small old buildings facing on West Jackson Blvd. because of the nature of their occupancy, but it is not



View Showing Danger of Present Situation in Toronto

easy to understand how fire got into the buildings to the south, which were protected as a rule by automatic sprinklers. I want, however, particularly to draw your attention to the number of narrow alleyways having exposed windows on each side, which doubtless afforded a ready spread for the fire.

The entire easterly facade of this building facing Clinton Street had the usual wooden window frames with windows of the ordinary glass. Wired glass windows were introduced in the Lightwell, and also on the west side to take care of the exposure from that side, but in view of the width of Clinton Street no such precaution was taken there. The fire started in one of the small buildings, as is shown on the diagram, at about 12:45 a.m. on the morning of March 15th and by 2:45 a.m. the Burlington Building had also been practically destroyed, as will be shown in the next picture.

Evidence shows that fire did not travel directly to the Burlington Building, but that radiant heat, and it must have been enormous, got through each of the upper storeys from the front to the rear and caused utter destruction on all floors above the 8th.

I have spoken of wired glass because up to this point it has been generally conceded that metal window frames in which wired glass was inserted formed reasonably good protection against any ordinary or even a severe fire loss, but in the case of the Burlington Building it has been shown that where wired glass was introduced the panes were of too large a size and that they, at various points, yielded to the pressure and to the force of the flame from inside, and disintegrated. Without enlarging on the circumstances that are so clearly shown in this picture, it is fitting that I should pause to ask how such a condition as is here represented, can be met and overcome.

I have had a number of pictures taken in the City of Toronto, and will throw them on the screen, where serious conditions of exposure exist, but in this paper there will be only one inserted and that was taken from my office window.

If you will notice the narrow alleyways, the exposing rear windows on nearly every building, you will see a spot in Toronto where there is an easy path for a spreading fire. It was just such conditions as this that caused the last Toronto conflagration, and not only in this case, but in many others, are we liable to have a recurrence because of the exposure from unprotected windows and doors, and here you have the problem of the engineer in relation to the fire waste, which I must leave with you for thought and consideration.

In closing may I mention that on the facade of the great Union Depot at Washington, D. C., there is a panel dedicated to the god of fire, upon which there has been inscribed by a well known artist, this motto:

"Greatest of discoveries enabling man to live in various climates, use many foods, and compel the forces of nature to do his work."

Yes, fire is a good servant but a bad master.

# PROBLEMS OF TOWN PLANNING*

By Horace L. Seymour, C. E. (Tor.)

"Town Planning is the scientific and orderly disposition of land and buildings in use and development with a view to obviating congestion and securing economic and social efficiency, health and well being, in urban and rural communities."—Definition approved by Town Planning Institute of Canada.

"Make no little plans; they have no magic to stir men's blood and probably themselves will never be realized. Make big plans; aim high in hope and work realizing that a noble logical diagram once rendered can never die but long after we are gone will be a living thing asserting itself with ever growing insistency. Remember that our sons and grandsons are going to do things that would stagger us. Let your watchword be order and your beacon beauty."—Daniel H. Burnham.

Every municipal engineer should understand the principles of town planning and should be more or less familiar with its technique. For a successful civic development the city engineer should be a city planner.

### History and Legislation

Town planning has been described as both a science and an art. As an art it has been practiced for centuries, as a science, merely with the century. Raymond Unwin tells us that the first historic case of town planning is that of the town of Kahun, in Egypt, where 3,000 years B. C. the town was built to provide for the needs of workers on the pyramids being constructed in that vicinity. Since that early date many examples might be cited of the practice of the art of town planning and would include the names of many ancient and modern towns and cities.

One of the evidences that town planning was becoming not merely an art but also a science is found in legislation in the sixties of the last century in such countries as Italy, Sweden and Prussia. Some of this legislation dealt largely with the matter of expropriation of land by which a community could provide for street widenings and extensions or other changes of advantage to the community. In most countries the power of the state in this regard is now generally recognized and upheld by law, but, up until a few years ago at least, in the city of Vienna for example, no property could be taken by the city without the approval of the individual. The providing of legislation, therefore, in the early period of the latter part of the 19th century was a considerable advance and permitted town planning to be treated from a more scientific standpoint than in the past. Most countries in the world have certain measures of town planning legislation either in force or being considered.

* Based on a series of lectures delivered to Fourth Year students in the Municipal Engineering Option, Easter Term, 1923.

Canada has been more or less influenced from two sources, these being the United States and Great Britain. In the Old Country town planning has been regarded largely from the health and housing standpoint and the British housing and Town Planning Act of 1909 grew out of previous health legislation. It did not provide for expensive corrective measures in the areas already developed, but it did endeavour to prevent the making of mistakes in new or only partly developed areas surrounding older development. The amended Act of 1919 gave town planning a wider scope and made the preparation of certain town planning schemes compulsory.

### American Developments

In the United States, Washington, the capital city, is a happy example of the earlier town planning art. A certain phase of town planning received a great impetus at the Chicago World's Fair in 1893. Here the wonders that might be accomplished through studying groupings of buildings were made apparent. There arose the idea of the civic centre, which has been of value in the development of the United States. It has also been detrimental in some instances to the idea of town planning in that it introduced an almost prohibitive expense to the average developed town in taking the necessary corrective measures to provide for a suitable civic centre.

Since then there has been developed very widely the idea of zoning, which is an important part of city or town planning and which, as opposed to the civic centre, is comparatively inexpensive to put into operation. In 1908, Alameda, in California, put into effect an ordinance under which the use and other characteristics of a building could be controlled. In 1916, New York, the largest city in the United States, put into effect an ordinance and since then hundreds of cities have followed the example or are considering doing so. In our understanding and outlook of city planning we are undoubtedly influenced by what is happening in the United States. In all but two provinces in Canada there is legislation of more or less town planning value. In such provinces, as a rule, the acts have followed largely the British Acts of 1909. In Ontario there is a Planning and Development Act which is an amendment of the Cities and Suburbs Plans Act of 1912, which was enacted largely through the efforts of the City Guild. There are numerous other Ontario Acts, but particularly the Municipal Act which contains town planning provisions applicable, as a rule, through municipal by-laws.

Frequently settlement preceded surveys, while now surveys, with few exceptions, precede settlement. Both the methods and the inaccuracy of early surveys were shown to have an effect on the present problems of town planning. Some of these effects are jogged and irregular streets; difficulties of opening up new streets through badly surveyed areas and difficulties in planning, due to the fact that original surveys were generally

made without regard to topography. It was shown that in some early surveys the areas were laid out by settlers themselves. In New Brunswick and Nova Scotia it was difficult and often impossible to find original survey monuments. The original surveys of Prince Edward Island, although magnetic, were well executed.

An interesting example of early radical planning in the Province of Quebec was illustrated at Charlebourg and vicinity, near the City of Quebec. While under French domination, there was an endeavour to provide, what has been so often mentioned, as very desirable, a village or centre with farms radiating therefrom. As a rule, however, we find the early farms of great length have been divided into narrow frontages, especially those on the St. Lawrence River. Townships now surveyed in that province are ten miles square with boundaries, north, south, east and west. The principle of long, narrow farms is still continued as having the advantage of close settlement. The result claimed is, that in Quebec, people do not leave the farms as in some provinces, where the method of survey has separated the settlers to a greater extent.

In Ontario there have been various systems and also a lack of system in township surveys. In the early days farms were granted or conceded along rivers or lakes. As settlement was forced further back from such main topographical features, the best means of transport in those days, further ranges of "concessions" were surveyed. The more recent system of surveys in Ontario have been the six mile and the nine mile townships.

Tribute should be paid to the manner in which township surveys are now carried out by the Dominion Government in Western provinces. Suggestions have been made for changes in the method of survey, which would make them as desirable for settlement as they are now excellent from a geometrical standpoint. In British Columbia it was shown that in the more mountainous country, lands were staked out very similar to the staking out of mineral claims.

In Western Canada out of over 200,000,000 acres of land surveyed, there was a few years ago but 20,000,000 acres under crop, while within twenty miles of a railway there were 15,000,000 acres of vacant land.

### Zoning

The term "zoning" is derived from the practices of the walled cities of Europe where the existence of arbitrary authority made it possible to carry out stringent regulations with respect to the character of the different parts of the city, various areas being actually in the form of a zone. In America, zoning might better be termed "districting or delimiting" as the areas to be regulated are not necessarily zonular in shape.

Zoning has been defined as public control of private property in the interest of the health and welfare of the people and as the determination of the character and intensity of the use of land, and more specifically as the

control under community power of (a) the height of buildings and (b) the percentage of area of lots that may be covered with buildings and (c) the use to which buildings may be put on private property.

The advantages that have been ascribed to zoning include the following: (1) Permanent development of the area concerned; (2) provision of adequate light, air and sanitary arrangements; (3) orderly growth of the city; (4) prevention of undue congestion; (5) stability of property values; (6) saving in the cost of construction of service utilities.

In a restricted sense the term "Town Planning" is generally considered to mean the public control of what is, or what is to become public property. As applied to cities it has been considered to include, for example: The street lay-out; sewerage system, water supply; transit and transportation system; port and terminal facilities; park and recreational system; location of public buildings. But public property in the average city or municipality constitutes but one-third of the area in street, parks, etc. From over one-half to two-thirds is private property. Zoning is that part of town planning which has particular reference to the public control of private property.

### Advantage of Zoning

The advantage of zoning is generally considered or it might be said is popularly considered, to be that of the protection of residential areas. There are advantages easily recognized by all those who enjoy home life. It is easy to fall into the error of unduly emphasizing this phase—the protection of the home being a popular appeal. While this is undoubtedly one of the aims of the town planner, he has other important and fundamental aims—the protection of the factory and factory sites; the protection of the business and business sites. The answer to "Why is a city?" or "Why is a town?" must be in general a commercial or industrial one. First of all there must be considered the location of industries and the protection of industrial sites. Then the location of business and the protection of business sites and finally the location of residences and their protection from the unnecessary intrusion of industries or business. Every zoning scheme must include the provision of an adequate transportation system to link these areas of various uses together. Scientific zoning means co-ordination not segregation.

### Planning for Sunlight

Various disease bacteria, such as typhoid, tuberculosis, etc., which can exist even for years in dark places, succumb to direct sunlight, of from a few minutes to an hour. Of particular importance in this regard are the matters of orientation of houses, disposition of rooms and the location of windows and verandahs.

For the free standing house, charts and diagrams may be made to show that the orientation most desired is that when the faces of buildings are not square with the cardinal points but at an angle of 45 deg. therewith. For streets in residential areas, the desirable direction is generally that of north-east, south-west and north-west, south-east, especially if blocks are square and not long and narrow. With high buildings on long, narrow blocks, the north and south street is shown to be the best street for main development. Ideally planned, the sunlit city would have a gridiron of long narrow blocks running north and south for the business section, surrounded with a checkerboard of residential streets radiating diagonally from a central development.

For the provision of sunlight as well as for other important reasons, the general rule is that the height of buildings should not exceed the width of the street or the distance between buildings.

**Practical Examples**

A parallel may be drawn between the city of Halifax and the town of Haileybury in regard to the physical location and the disasters which called for the solution of problems for rehabilitation. These offered an unusual opportunity for replanning.

In the Halifax disaster of 1917, funds were made available for, and sufficient powers vested in the Halifax Relief Commission, so that all residents suffering in the disaster were reimbursed for losses and were provided with temporary shelter in the form of rows of frame houses in various parts of the city, but *not* in the area which was being replanned for future occupation. This was a comparatively easy solution of the problem, but such treatment was not possible in Haileybury. No immediate fund was available to meet private losses, but lumber for temporary shelter (a "shack" 16 by 20 ft.) was being provided by the Relief Organization. It was necessary and reasonably so, that an owner should be allowed immediately to erect a shelter on his own lot. Building permits issued however, have been almost entirely for temporary buildings to be renewed or made to conform to building by-laws in force on the 30th October, 1923. In many cases the owners, who must keep their temporary buildings in ordinary cases at least 20 ft. back from the street, are putting them back further to be used as kitchens when the permanent house of the future is erected.

In considering the problems of planning in Haileybury, the relation of Haileybury and its urban zone, and its relation to adjacent towns with their urban zones, must be understood. The lack of proper topographical maps hampered the work to no small extent. Council by-laws provided for fire areas and the segregation of residential from busniess, warehouse and factory sites.

# *Old School*

## 1891 — 1901

"School!!!" And 800 *enthusiastic* engineers rend the heavens with a "Toike Oike" that leaves in oblivion more intelligible yells.

"School!!!" And 800 *excited* engineers are on their toes, thirsting for Meds' blood and Arts' gore.

"School!!!" And 800 *enraptured* engineers cheer on that loyal team to victory.

"School!!!" And 800 *enthused* engineers uphold the honor of the Blue and White.

"School!!!" And 8,000 *eminent* engineers from every clime, country and calling, look back with love and loyalty upon that "Old Red School House."

What is this intangible yet intrinsic and dynamic feeling that lays hold upon our innermost beings by those two words "School Spirit?" What is the reason for this friendship and fellowship, this inherent affection so symbolic of "School" men, graduate and undergraduate? Does it not find its origin 'way back in the olden days; 'way back in the years that have produced some of the most illustrious engineers and leaders in our Canada and other nations? We are proud to uphold the traditions, the ideals and loyalty to our Alma Mater, handed down to us from our engineering forefathers. We cherish the memories and the successes of those men who not only brought into existence this "School" and "School Spirit," but who have gone out into the world and laid the foundations for that practical science upon which we aspiring students hope to build.

Now let us turn back to those pioneer days. Let us have a squint at some of those prominent engineers at School. From our humble and inexperienced position we look with awe upon their successes and accomplishments and we often wonder to ourselves just what they were like in their youthful days. Did they participate in some of our spirited but foolish antics? Were they always getting into trouble with other faculties, the S. A. C. and the "powers that be"? Did they experience the same reluctance to arise for those nine-o'clock lectures? Did their thirst for knowledge overcome that welcome for the minute hand's arrival at the hour?

As we were saying—from our humble and inexperienced position we are inclined to wonder. Let us see:

### A. T. Laing—'92

When the class of '92 knocked at the door of the little "Red School House" for admission there were twenty-eight in all, constituting the largest class up to that date. The ever-watchful and faithful servant "Prof." Graham was on hand to extend a word of welcome, the usual salutation be-

ing, "Well, young man, what are you doing around here?" delivered in such stern tones and in such an authoritative manner that the timorous freshman felt certain on the outset that no liberties could be taken with the caretaker. It was soon realized, however, that he was not only the faithful servant but also a good-hearted friend of the students. He was a living part of the old school and the students from year to year for many years gave tokens of their appreciation of his character and many kindnesses. His old friends will be glad to know he still enjoys life in retirement.

Matriculation, at this time, was not a prerequisite to admission, but the applicant was supposed to have a certificate from a high school master of good character and a statement of the advanced work he had covered. Failing this, he was asked to have a quiet talk with Principal Galbraith, than which some declared they would have preferred the matriculation examination, but it resulted usually that none who were really in earnest were turned away.

The class comprised representatives from nearly every walk in life, and it was claimed by one member that he could discern from the vernacular the environment from which each had come; the son of the soil drew his illustrations from farm life and so for the son of the tailor, the merchant, the physician, and we may be pardoned if we omit here the language of the lads from the parsonage. But there was one about whom there could be no conjecture in this regard, the seafarer. The deep sonorous voice of Virgil Marani was like the sound of many waters, at times thundering and tempestuous. His language at times was, perhaps, more forceful than elegant, but it was direct and unambiguous, and was profusely punctuated with the phraseology of the sailor. His spellbinding stories of life at sea made him very popular. It is no reflection on students of the present day to say that seriousness and definiteness of purpose was, perhaps, more in evidence than at present, due no doubt to the fact that the average age at entrance was about 22 years as compared with 19 years at present.

There was no rendezvous for students, no supply department by the Engineering Society and the library of the Society, still in its infancy, was cradled in a small room adjoining the furnace room in the basement. Having outgrown this space, room was provided on the top floor and the students were assigned the task of moving. It consisted of about one trip for each man carrying one book. It is interesting to note in passing that the only smoking then was indulged in by the caretaker, who confined his operations to the furnace room and took great pains to see that the furnace was an efficient smoke consumer.

An interesting feature of each session was the opening meeting of the Engineering Society which took the form of an experience meeting, the students giving an account of their summer's work. On one occasion a student who had a reputation for a disregard for personal appearance and an

aversion to bathing, related how he had had to chain through water well above the waist. Some doubt was expressed as to his statement, but a friend vouched for him, stating that he had seen the high-water mark.

One event which overshadowed all others in magnitude and importance was the disastrous fire of February, 1890, which destroyed the east wing and the greater portion of the front of the University. It was a staggering loss, including as it did many valuable records, an excellent library, many volumes of which could not be replaced, as well as a costly building. It was on a night set apart for a Conversazione, which was an annual affair and was the one and only big event of the session—how different now. The School was assigned a room for display and this was suitably fitted up, representing in one corner a surveyor's camp and about were instruments, chains, pickets, etc. The walls were decorated with many *beautiful* and *valuable* drawings of the first year. All was a total loss and the poor students received no consideration except that no one was plucked in drawing that year. Up to this time the rooms of the University were not equipped even with gas fixtures and for special occasions lamps had to be borrowed and mounted on improvised chandeliers. The origin of the fire was due to the carelessness of a servant who, while placing some of the lighted lamps, upset one amongst a lot of others and all burst into flame. The point at which the accident happened made immediate extinction with the means available impossible. The facilities for fighting fires from without were entirely inadequate and before the fire could be controlled the building was in ruins.

The next noteworthy event was the construction of the southerly portion of the present Engineering building to meet the growing demands for space. The building was completed during 1891 and to celebrate the occasion a formal opening was held January, 1892. It was an auspicious occasion. The whole building with the newly-equipped laboratories in Mechanics of Materials, Hydraulics, Electricity and Thermodynamics, etc., were thrown open to visitors and the budding engineers of the graduating class shone forth in great splendor as, arrayed in blue jean overalls, they operated the machines which they understood little better than did the spectators.

The new building, on account of its outlines, was not considered a thing of beauty and went under the name of Galbraith's Factory. At a University convocation held in the present first year drafting room in 1891, the then chancellor, The Hon. Edward Blake, congratulated Principal Galbraith on the expansion, and particularly on the establishing of a department of architecture, stating that there could not be a better place for such a school. In the University building was something to inspire and to be emulated in design, while in the new school building was something to be avoided.

During the years to which this brief sketch applies, there was a growing demand on the part of the students for recognition other than that set forth in the graduation diploma. It was urged upon the Faculty Council that

there should be a degree established. The council was sympathetic but it did not have degree-conferring power. An arrangement, however, for such recognition was brought about by the council with the senate of the University whereby in January, 1892, the degree of Bachelor of Applied Science (B.A.Sc.) was established. The requirements of a candidate for this being that he should hold the diploma of the School of Practical Science or be of fourth year standing in the honor department of Chemistry and Mineralogy of the University of Toronto. The session 1892-93 saw the first class registered in what was called the post graduate course leading to the B.A.Sc. degree. The class consisted of eleven men, eight of whom were from the class of '92 and three from previous years, and all were successful.

One cannot close without reference to the two outstanding figures, the late Dean Galbraith and his intimate friend and colleague, the late Dean Ellis, men of widely different characteristics but in a remarkable way the one the complement of the other, men of surpassing ability and attainments in their respective fields and who found at the same time an abiding place in the esteem and affection of all students. Their aims and objects were to build up an institution worthy of the name and to aid all who sought its benefits, and their achievements in these respects are at once a challenge as well as an inspiration to all who follow. Their memories are cherished by all who came under their influence.

"When great men die,
For years beyond their ken
The light they leave behind them lies
Along the paths of men."

A. T. LAING.

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## C. E. Langley—'92

My first recollections of the "Old School" began with the curiosity excited by that wind gauge affair which used to spin and glitter above the skyline, and which could be seen from the dog-pond where, as kids, we used to sail our toy boats. Perhaps there was a subconscious determination even then, to learn, some day, what went on inside those red walls.

That "dog-pond" was then a picturesque institution in Queen's Park—Toronto's Serpentine, in fact. A little lake formed by a high dam across the creek at the eastern entrance to the campus; and so, just south of where Hart House now is. "Musk Rat" I think the creek was called, but this may be checked by a reference to our freshman's survey drawings of '88; for as fate would have it, this very spot, drained by scientific vandals, was chosen for us surely out of pure cussedness like lots of other things because hard to get right, as a fitting place for wee Davie Burns to put us over the bumps with the instruments.

About this time it seems to have been realized to some extent at least, that the fine Arts had, as a matter of concern for the University, been neglected, and in '89 the Architectural course was started. C. H. C. Wright for staff; yours truly for class. It is a matter of pride with my mother-in-law to show the newspaper clipping indicating my standing: No. 1 in every Architectural subject. This course has gone steadily forward, as we all know, until now it is to be reckoned with and a justified cause for pride. Naturally it can yet go far, and besides furnishing professional education, be a great factor in the necessary cultivation of, and general appreciation in fine Arts, by people who call themselves well educated.

The fine Arts of a nation might well form a better skeleton than Kings and dates on which to hang history: and general cultivation and appreciation is necessary if Canadian Art is to take its proper place. It is food for thought that so few, even leaders, have any knowledge of the eternal fitness of things in matters of beauty. Perhaps, some day, it will not be optional to remain ignorant on these things.

I seem to have got away from the few little recollections I had intended to put down, and now I have taken up much more space than you wish me to occupy.

I might have mentioned the distinction S. P. S. had in the fact that it was our assistant janitor, "Game" Goodwin, who dropped the tray of oil lamps in the East Wing and so thoroughly set fire to University College the night of the Conversat. We did our best to kill "Game" at Wellesley School when boys, but he was destined to a higher end.

There was a splendid demonstration of cultured boneheadedness at the fire, suggesting "presence of mind" as a compulsory study: the recklessness with which the mattresses and pillows were carried down stairs from the residence, and the care exercised in hurling carefully articulated skeletons from the museum windows, was truly beautiful in a cubist way of speaking.

Another regrettable incident: when the sodium exploded and Dr. Pyke's eye was hurt. We didn't realize that at the time, and were only vastly entertained at Jo Jo Bonstead, his assistant, who seemed mortified, knowing that sodium shouldn't kick up in that way, properly handled.

C. E. LANGLEY.

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## Walter J. Francis—'93

In order to appreciate this little story of my years at the School, you will have to move your mind back thirty-four years—a rather long period to look forward to but very short in retrospection—for I entered the School in 1889. In those days things were different from what we have them now. That was before the electric street cars. Horse-cars and stage

coaches ran on Yonge Street then, and I remember the stage coaches used to be parked in front of a tavern on Yonge Street just opposite where the Simpson store now stands.

My rector at the old Grammar School had told me of the glories of architecture, and I went to the School to look for an architectural course. There was none. I was enrolled with the Civil Engineers of '92, and I took some extra lectures to help fit me for the architectural profession.

Varsity was very different from what it is now. The Main Building stood in solitary majesty beside the beautiful campus which was the pride of all Toronto. It was the only important building then standing of the whole University group. Taddle Creek meandered down the valley which is now usurped by Hart House, the Library, the Medical Buildings and the Biological Building. The School was a lonely red brick building nestled beneath the great elm trees still standing and next to the high garden fence of the Observatory, in which grounds the Weather Man—the same old Weather Man, but he was not Sir Frederick Stupart then—had all his mysterious little structures used in making the weather. The main building of the Observatory stood in what is now the middle of the street leading from College Street up to the Main Building. It was moved and re-erected stone by stone on the site it now occupies near the Main Building. I do not remember what was on the other side of the School building, excepting that there was some broken ground and Wycliffe College stood facing on College Street. The School building as we knew it was that part which now forms the north wing of the present red brick building. The front door faced on the campus. Above its lintel were engraved mystic characters forming words. Perhaps you have never appreciated that doorway. While it is not so beautiful as many of the other University portals, it is, nevertheless, beautiful because of the memories which surround it. There was one wing of the Biological Building completed—that part with the semi-circular end on it. The little red brick Y. M. C. A. building, with its single polished granite column at the entrance, occupied a prominent place at the front entrance to the grounds from College Street.

The old School building, small as it was, was more than sufficient for the needs of the school, the activities of which centred on the middle floor. There were three professors—Professor Galbraith, Professor Ellis and Professor Chapman. Mr. L. B. Stewart was lecturer in surveying and there were two other junior members of the staff. Mr. Stewart was also the secretary.

I recall very clearly that R. A. Ross, of Woodstock, now Dr. R. A. Ross, of Montreal, was the only student in mechanical and electrical engineering. He used to take a number of his lectures all alone in Professor Galbraith's room. When he came out he looked so wise that we all wondered whether there was room for another idea in him. Up to this time there had been only about fifty or sixty graduates of the School, and we had all heard of Morris and Tye and Duggan and Thompson and

Haultain, but few had the opportunity of making their acquaintance personally. C. H. Mitchell, now Brigadier-General Mitchell, the Dean, was a member of the class of '92. He knew the ways of Varsity better than the rest of us because of his having been a year or two in Arts before he entered Engineering, and we all appreciated his superior knowledge and experience. The Engineering Society was flourishing then in the fourth year of its existence. It was founded two years before the Canadian Society of Civil Engineers, and H. E. T. Haultain was the first student president. Before his time Professor Galbraith occupied the presidency of the Society.

All these things were before the days when School men counted on the Varsity multitude. We took a lot of our lectures in the Main Building—Sir Daniel Wilson was president then—and sometimes we had lectures from the University professors who came to the old building. John A. McGowan, now Professor McGowan, gave us our lectures in trigonometry, while Professor Alfred Baker, his senior, delivered the lectures on calculus.

Probably the outstanding event of that first year was the disastrous fire in the Main Building, when the greater part of the front and the whole of the east wing were completely gutted. During the afternoon I had been helping with the decorations for the Conversazione to be held in the evening. On my way home at dusk I saw the reflection of a great conflagration, not dreaming at the moment that it could be the old building of which we were all so proud. It seems an oil lamp had been upset and had ignited some of the decorations. The east wing, by the way, used to be Convocation Hall, with the basement of which sulphurous fumes and muffled groans of the freshmen used to be associated.

I was deeply impressed with the first Literary Society election I attended. It was in a hall downtown—I forget where. The most important duty that any student had was to cast his vote, and I remember I succeeded in exercising my franchise at about three in the morning, after which I returned home sore but satisfied, minus a coat sleeve and most of my buttons.

The glamour of architecture faded when I learned the prospective wages, and having obtained a position on the construction of the Toronto Belt Line Railway during the vacation, I thought I developed a liking for engineering, so in the autumn of 1890 I returned and entered regularly as a freshman in Civil Engineering. That was the year when the remainder of the old red school house was put into commission. It had been finished during the vacation and we took possession in October. Professor A. P. Coleman took the place of Professor Chapman, and Professor Galbraith and Professor Ellis continued as before. Mr. C. H. C. Wright and Mr. T. R. Rosebrugh, both of whom have since been elevated to the professoriate, were added to the staff, and Mr. Wright had charge of the newly-formed architectural course. The first year of the '93 class began the crowding habit that became so marked at the old School twenty years later. But the years succeeding '93 were much smaller, and, if I remember well,

'93 was the largest year of all until the graduates of 1900 or 1901 were turned into the world. We had with us J. M. R. Fairbairn, now Dr. Fairbairn, the chief engineer of the Canadian Pacific Railway, and L. C. Charlesworth, now Deputy Minister of Public Works of Alberta, and N. M. Lash, now chief engineer of the Bell Telephone Company of Canada. We also had Frank N. Speller, the great authority on the manufacture of steel tubes, as well as many others I could mention. Our ways were pleasant ways, and there is not one who does not smile to-day when he thinks how Nor. Lash could walk on all fours, and how Virgil G. F. Marani was always "the life of the party." Then, just as for twenty or more years to follow, as regularly as the evening came we heard the familiar voice of Prof. Graham ring out "Five o'clock, Gentlemen!" and we left the rooms reluctantly.

In speaking for myself, I formed associations and friendships in those times which have become more firmly cemented as the years have rolled by. There are five of us—all old Toronto boys—in Montreal, where we have been for years. Although relatively large in numbers, our professors knew us individually. The culture and manly charm of Dr. Coleman were appreciated by all, and when Dr. Galbraith and Dr. Ellis graduated into the Greater University I felt that I had indeed lost two very close friends.

Many of the old-time students I have mentioned are known throughout the length and breadth of the land and have attained positions of importance in the community. The profession has not failed to recognize their worth and interest, for Mr. Tye, Mr. Duggan, Mr. Ross and Mr. Fairbairn have all been honored with the presidency of the body which represents the engineering profession in Canada—the Engineering Institute.

I like to go back to the old place—indeed, I do go back every time I can find a reason, or, more properly speaking, an excuse to do so. It is most refreshing to talk for a while with those who were there when I was, and it is very pleasant to recall old times and still more pleasant to renew old friendships.

Yours very truly,

WALTER J. FRANCIS.

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## L. C. Charlesworth—'93

The freshmen class of the fall of 1890 when I started in at the Old "School" was, I believe, much the largest in the history of the school up to that time, and was so much stronger numerically than the second year that we practically all escaped the "hazing" that according to time-honored traditions we should otherwise have received.

It was, I believe, the first year that the enlarged building was put into use. Prior to that time what was the north wing of the new building had

comprised the whole "School." The new first year draughting room, which had probably been designed to take care of the expected increases for some years to come, was well filled by the large freshman class.

That, too, was I think the year that C. H. C. Wright, who had graduated with high honors a few years previously, joined the staff. The other members of the staff were "Johnny," "Louis B.," "Doc. Ellis," "Chappie," "Rosebrugh," "Duff," "Cæsar Marani" and "Five-o'clock-gentlemen Graham." Dr. Coleman came a year or so later.

Among the students in the second year was the present Dean, "Charlie" Mitchell, and he was, I think, one of the first outside of our own class with whom I became acquainted. This acquaintance was the result of a transaction which was very satisfactory to me and probably just as much so to him. By it I acquired some second-hand text books at reduced prices. Deacon and Dunbar were also there and the boxing bouts, or rather slugging matches, between these two heavy weights certainly provided lots of entertainment. C. H. C. Wright was a fine football player (association) and the School shone in that line, Alex. Goldie and Kit Forrester of our year being prominent players. One of the best-known figures of our year was Virgil Marani, a brother of Cæsar's. Virgil, who had spent much of his life at sea and held, according to report, first officer's papers for sailing vessels and second officer's papers for steam vessels, had come in the previous year as a special student and then started as a regular student in the fall of '90. He was a striking looking curly-haired Italian with the devil in his eye, and though not tall was built like a bull and was just as strong as one. Virgil could talk at any time on any subject and loved to do it, and as he had a wonderful fund of experience and had travelled all over the world his tales were a never-ending source of entertainment. As he himself said, the more people there were observing him the happier he was. When things grew dull in the draughting room Virgil would be given a subject and called upon for an impromptu speech which you may be sure was never dull but which was suddenly interrupted and wound up with the remark, "Oh, my God! There's Johnny!" Whenever there were any grievances to take up with any of the staff Virgil was the man deputed for the job and his talk could charm fairies any time.

Literary society elections were at that time a matter of brute strength. The party strong enough to get possession of the polling place permitted none but its own supporters to vote. Needless to say, Virgil's assistance was eagerly sought by both parties each year and when stripped and vaselined for action he was a vicious looking object to tackle and helped materially to win elections. He was a prominent member of the Lit for that one evening each year.

Other members of the class were Jack Fairbairn, Frank Speller, Jim Robertson and Nor Lash, who when a lecturer happened to be late used to entertain us, and probably could do so still, by walking on all fours with

his palms flat on the ground and his knees and elbows stiff. There was also Walter Francis. Francis was a beautiful draughtsman, and those being days of depression and of difficulty in getting jobs, his draughting generally gave him an entering wedge ahead of the other fellow. He has since attained an eminent position in the engineering profession and whenever I hear a student or young engineer expressing the opinion that time spent in acquiring skill in draughting is wasted and that "once a draughtsman always a draughtsman," I try to change his viewpoint. Of course, outside of the draughting altogether, Francis could deliver the goods.

For physics we had to go over to Professor Loudon in the Arts Building. The physics lectures were attended also by certain Meds. Our large class crowded the lecture room so that a number usually had to go without seats and a small sized war usually occurred between S. P. S. and Meds accordingly. In spite of this, S. P. S. and Meds would unite against Arts any time. The same condition of crowding existed in some lectures taken jointly by Arts and Meds and on one occasion an S. O. S. call came over to us from the Meds asking for assistance in a big fight over at the Arts Building. We all turned out and it certainly was a real scrap, involving practically every student in the University. Being finally driven from the lecture room and corridors by the fire hose, we repaired to the campus and kept the row up all day. Not a lecture was attended by anyone. Next morning all were surprised on arrival to see the campus and buildings guarded by a considerable squad of city police. Had this not occurred the fight would probably have been a thing of the past, but the sight of the police was sufficient to start a real row. All hands united to round up the "bulls" who soon took refuge in one of the small white brick houses which then stood near the southwest corner of the campus. The crowd surrounded the house leaving an open space in front in which Virgil stood and addressed them and the police in turn. He had a beautiful and varied vocabulary for such an occasion. What the outcome would have been it is hard to say had not Sir Daniel Wilson, the President, who was then in poor health, but intensely popular with the students, appeared on the scene. He had been summoned from home, where he was really ill, as a last resort. In a short address he appealed to us to disperse and we gave three cheers for Sir Daniel and went back to lectures while the police slid out the back door and went home.

These and similar occurrences of seemingly no importance are the things that remain as evergreens in my memory of those days and while I fear that they may prove too trivial for your own use, I send this along for what it is worth.

L. C. CHARLESWORTH,

Deputy Minister Public Works, Edmonton, Alberta.

## H. V. Haight—'96

My time at the old S. P. S. was from the fall of 1893 to the spring of 1897. Attendance was at a low point, about 125 in the whole school, I think, but the quality I think was high, as it included R. W. Angus and J. W. Bain, who were classmates of mine, and C. H. Mitchell, who was a year or two ahead. In Arts I remember seeing several times W. L. M. King, as he was then called, and I believe Mr. Meighen was also at Varsity, though I don't recall hearing of him at the time.

My most distinct recollection of C. H. Mitchell was his paper before the Engineering Society on the subject of Flying. Even then his explanation of soaring flight seemed to me to lack something, and I see now that it did not recognize the need of an upward component in the wind to render possible sustained gliding or soaring flight. Of course, at that time man had never flown.

Of W. L. M. King I remember his announcing at the sports, for which his great voice was well adapted. One theatre night, when the "Gods" at the old Grand was filled with us, King sang a solo between acts, up there in the "Gods." It was fearfully hot and King was minus coat, vest, collar and tie. A few days later I heard him sing at a concert in Massey Music Hall, very correctly attired in evening clothes.

In my fourth year about half a dozen of us chose French for our language option, and were taught by "Johnny" Galbraith himself in his big office. He knew French well, and he knew how to teach, though his methods were original, and we did really learn some French, but had considerable fun in the process. We had been over some article in the "Competes Rendus" pretty thoroughly till we knew both the French and the English by heart. Prof. Galbraith read a sentence in French and asked Bert Angus to translate. Bert had been talking to Charlie Macbeth and hadn't heard the sentence, but glibly gave the English of a sentence about a paragraph farther on. Prof. Galbraith said, "Oh, Mr. Angus, we haven't come to that yet." Prof. Galbraith's assignment of home work was to tell us to take any French article we liked, translate it into English and bring the translation. He read the translation to make sure it wasn't "Frenchy" but didn't compare it with the French. This seemed to leave a loophole, so once, I think I was the guilty one to suggest the experiment, we all decided to copy out some English article that never had been in French. It worked. Bert Angus was commended for his very free translation.

It was interesting to be at the beginning of some scientific developments. I saw a demonstration of wireless waves, Hertz waves I think they were called, when they were transmitted across the lecture room.

Some of the first calcium carbide that Wilson made was sent over for a meeting of the Engineering Society and we saw a demonstration of the acetylene light.

When the news of the discovery of X-Rays was cabled from Germany some experiments were immediately made at the S. P. S. and I had one of the early X-Ray photos.

Yours truly,

H. V. HAIGHT.

## E. H. Darling—'98

In reply to your favors of the 4th and 18th inst., I do not know that I have much to contribute in the way of reminiscences for the year '98.

The freshman year of '95 was one of the smallest since the School began to grow. Not more than thirty-six made a start, and of those who completed their three-years' course I do not believe there are more than a dozen left. Many dropped out, some have died, and at least one of our members gave his life in France.

Being a small year we naturally did not make a very loud noise, and went through the course watching our step. There was, however, one outstanding event in the first year. Half a dozen of our men were stale freshmen, all big husky members of the football team. Their presence, I imagine, had a great deal to do with the fact that the sophomores never attempted any duckings as far as we were concerned. As they failed to do their duty in this case the said stale freshmen undertook to carry out their responsibility. Their plot, however, was discovered and while they were lying in wait in the old cloakroom in the basement after 5 o'clock in order to waylay the rest of us as we straggled in, they were suddenly surprised by the whole year descending upon them in mass. The result was a fierce engagement in which nearly all of the conspirators got the ducking instead of their intended victims.

We were told afterwards that during the height of the combat "Good Old Johnnie" walked the floor of his office wringing his hands and urging everybody to stop the fight in order that he would not have to go down and make trouble for some of us.

During our term the School won its usual number of championship matches and I believe I am correct in saying that the glorious Toike Oike first rent the air. Surely this is enough honor for any year.

Yours truly,

E. H. DARLING.

## F. W. Thorold—'00

Replying to your letter of the 4th inst., I take pleasure in recalling a few of the incidents occurring during the years 1898 to 1901 at the old "School."

One cannot think of the old days at the School without thinking of the man responsible for its very existence. Dean Galbraith, known by all as

"Johnny," was the friend of every man there, and when I look back at the various "trials" held in his office in an endeavor to find out which year committed certain outrages (?) I cannot help but remember the little twinkle which used to be in his eye as the evidence was extracted. I think Johnny took about as much pleasure out of those "trials" as we did.

C. H. C. used to be looked on as a pretty fair photographer in those days and Johnny used to send C. H. C. out with the camera to get a photograph of the ringleaders in many of the scraps. Of course, I don't suggest that C. H. C. intentionally spoiled the plates, but such photos were usually out of focus or spoiled in some other way.

Once we stole the cannon from in front of the Military Institute and took it up to the School. Meds soon found out about this and after many battles they captured it. That old cannon frequently passed from Meds to School and back again, and the last I remember of it was that it had been dropped down between two of the Med buildings. Oh yes, we sure did shoot it off and broke lots of windows too.

There is one incident I can never forget. Prof. Duff, also called "Johnny," was lecturing to us in some third-year subject. There was a scrap going on outside between School and Meds. About half way through the lecture Johnny Duff walked over to the window and looked out. We could see him smile. Then, without turning from the window, he drawled out in the lowest tones, "Gentlemen, I think the School is getting the worst of the scrap." Exit 3rd year en masse!

There were an awful number of liars at the School in those days. When Doc. Ellis would endeavor to show us some complicated calculation in chemistry and would say "seven and three are sixteen and this added to eleven is nine" and would then turn to the class and say, "Is that right?" every man there would say "Yes, Sir."

Of course, we had tapping and painting in those days. We practised on our own men and then showed Meds how it was done. We seldom had a scrap with Arts, although they outnumbered School many times.

Speaking of painting, I remember when the stone steps leading to the main entrance of the Red School were painted. The top step was yelllow, the next blue and the next white and so on for all the steps. I forget what the fine was, but there were two men removing paint from those steps for many days.

Taking a hurdy-gurdy through the halls of the School and then into the lecture room was tame in comparison with the time that we took a full-fledged Highlander playing the pipes into one of the galleries at the Parliament Buildings while the House was in session. Why this was done I cannot remember, but I suppose there was a reason (?) There was always a reason for everything we did in those days.

At the time of the South African War, we always had a parade down town when good news arrived. I remember when Kruger was captured, we got a Grand Trunk lorry and mounted a large cage on this. A rather quiet fellow in the first year was "selected" to act as Kruger and he was put in the cage and the cage tied down. He wore a beard and really looked like the pictures of Kruger. The placard on the cage stated that this was really Kruger. All went well until we reached Queen and York Streets and then a mob of kids plentifully supplied with choice rotten eggs serenaded Mr. Kruger. The cage was open on four sides and poor Kruger could not get out.

Hallowe'en night was the big night. Theatre first and then quietly disperse to meet again somewhere above College Street. Of course the police would be on hand in swarms and just as soon as we attempted anything they would charge us. Then we would disperse and meet again at one of the Ladies' Colleges. Once in a while a man would be captured by the police but usually the police were contented if they could wallop a few of the boys on the head with their batons.

We were serious in those days too. I remember we had every newspaper in Ontario publish an article stating that a new Mining Building was necessary at the University. We had letters written to every M.P.P. and many of them were seen personally. We had resolutions passed by the Manufacturers' Association and the Board of Trade stating that such a building was required. All the newspaper clippings were pasted on a roll of paper about 12 inches wide and "miles" long. An appointment was made to meet the Cabinet and our best speakers were selected. The climax came when the roll was dramatically unrolled before the members of the Cabinet and the opinion of the Press was presented in compact form. The new building now stands at the head of McCaul Street.

There were no year yells in those days. Last year the years '98, '99, '00, '01 and '02 organized and called themselves the "Century Group." Watch us at the next Annual Dinner and you will admit that while we are all getting older (not old) we still have lots of the old School pep left.

Five o'clock, Gentlemen.

Yours sincerely,

F. W. THOROLD.

## And now:

"Five o'clock, gentlemen!"

The lecture is over. The picture of the "Old School" has been drawn to a close. From the dim past, where we have been wandering through the childhood days of our "little Red School house," through exciting police encounters and Literary Society elections, through time-honoured Med. scraps and theatre nights, we reluctantly drift back to 1923. But in our return we have brought with us a new interest and affection. We'll make it a point of having another look at those engraved letters over the northern entrance. Let's stroll around to the old Y.M.C.A. building and make a closer scrutiny of its weather-worn structure. Those old pictures of austere-looking gentlemen, past which we've hurried for that nine o'clock lecture, mean a little more to us now that we've had a look into the bygones.

So we have seen the birth of this School Spirit; we have followed its infancy through the pioneer days when it grew in leaps and bounds due to the necessity of its existence, and now it has reached, in our time, its height of youth. Let us hope that it remains in this youthful stage, may it never grow old, but be a constant source of memory re-awakening for our graduated predecessors who knew it in its childhood, and a constant source of incentive for we who are about to depart from its portals.

We would like to take this opportunity of expressing our sincere feeling of gratitude to these men who so generously contributed articles for this "Old School Reunion." It has brought us closer to them and as we followed them through the memorable past, a closer "tie that binds" has come into existence. The success of this department of the Year Book has rested entirely in the hands of these graduates and the way in which they have responded has shown us that their love and loyalty to our Alma Mater is undying.

This "Old School Reunion" has been a new departure for "Transactions," having its first appearance in last year's issue. The idea was an excellent one and has brought a new interest in this publication, not only for students, who have acquired a new slant on "School's" life, but for those graduates who were present in the foregoing events, this book will awaken old experiences and acquaintances. So may we take this opportunity of congratulating the originators of the idea and of expressing the hope that it will remain as a permanent department of "Transactions."

# A Message of 1923

This is a year of Service. This is a message for the readers of Engineering Society Transactions in this year of Service. Service is needed now just as much as it was ten years or five years ago during the war.

The members of the Engineering Society who have produced this volume, and the undergraduate and graduate members who read it, are living and working in the midst of a period when Service is at a premium. Are you going to take advantage of it?

Yours is the advantage. You are prepared, you are, as young engineers, naturally the kind of persons for Service. It is to you that the State and the Country generally, will look for the nature and extent of Service that is needed for these next few decades in the development of this great Dominion of Canada.

You will spread over the Dominion, over the Empire and over the World. The preparation you have had in this University and the experience you have gained by playing your part in the work of the Engineering Society and in the publication of these Transactions will stand you in good stead wherever you may be and with whomever you may be in contact.

Play the game of Service; it is worth while. It is worth while to the Country, to the profession, to your comrades and to yourselves. May I again ask you to remember the old saying that he who would be great among you must first serve.

My best wishes go to you whether you are graduating or remaining for other years, whether you stay near home or spread to the farthest parts of the Continent. I will expect you all to be serving and subsequently leading wherever you are.

(Sgd.) C. H. MITCHELL,

*Dean.*

# Transactions and Year Book

*of the*

University of Toronto Engineering Society

With which is incorporated "Applied Science"

PUBLISHED ANNUALLY BY THE SOCIETY

No. 36 TORONTO, APRIL 15th 1923




# *Editorial*

With this issue the "Transactions of the Engineering Society" completes the thirty-sixth cycle of its existence and the third since its rejuvenation. The history of the publication is practically a history of the School of Science. It is the Society's official record of accomplishment and is, as such, submitted to alumni and undergraduates.

In collecting material for this volume certain papers have been included which were not actually delivered before the Society but the aim has been to strike a medium between the ultra-technical paper and the general article, yet to have each justify its place in an engineering publication. The Year Book, the account of what Schoolmen have done in the past Session, is a record of real achievement in which everyone has had a part and upon which all may look with true pride.

Attention is directed to the section dealing with the "Old School" for it is upon this foundation that we of the present day and generation must build, and with which we should all be familiar. Only by looking backward upon the traditions handed down by those who trod the path before, may true School Spirit be builded with which to face the future.

And so "Transactions, 1923" goes out. For its shortcomings the fault is our own, and for any merit it may have credit is due to those members of the Engineering Society who have made it possible.

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## *The Society—and Its Members*

On reviewing the past four years from the standpoint of an undergraduate, one is struck with the versatility of the men of School. In the field of sport and the field of learning the men of this faculty have acquitted themselves with great credit. From pink teas to debating platform, from gridiron to squash court, from a rough house to a formal dance, even from the sublime to the ridiculous, following one another with lightning-like rapidity, School men seem to be able to carry themselves with ease. Whether this be due to a chameleon-like character produced by necessity or to a combination of initiative and adaptability produced by environment and training, it is difficult to ascertain.

But one thing seems to be certain and that is, that in School life with its wide diversities of thought and action, the controlling factor in the make-up of character has been the influence of the Undergraduate body known to us as the Engineering Society. In its welding effect it should give a spirit of loyalty and unity as well as a sense of independence which should go far in years to come to produce true citizenship and all it involves— "Wad some power the giftie gie' us—" but apart from parchment and penwipers, the severing of relationships with School, and that which makes School —the Society—will come hard to all of us. And so it is with some slight courage backed by many happy memories that we of this year's graduating class set forth into life to do, to dare, and to achieve, what, we know not yet.

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## *Pat Lyle—An Appreciation*

School spirit—education—executive and athletic activities. To take an intelligent interest in one and all and to balance properly the pendulum between labs and lectures on the one side and sport and "joy-jobs" on the other has been the problem of many a good School man before this.

Pat Lyle has run the gamut of University experience during this past year. Besides being President of the most unified and outstanding body of undergraduates in the U. of T. he has managed to take an extremely active interest in the affairs of the S. A. C., the Board of Stewards and the House Committee of Hart House. At no time resting on his laurels but ever ready with advice and assistance, Pat has achieved successes the nature of which are granted to few to obtain.

His regime has been one of innovations. In handling the initiation question, establishing School Night on a sound basis, breaking the ice with the employment situation and above all in centralizing the activities of School in the Engineering Society, he has had complete success. At the same time he has handled School's affairs impartially and with a loyalty that is hard to resist and has been responsible to a large degree with the extraordinary efficiency with which matters pertaining to School and Schoolmen have been carried out during the session 1922-1923.

Irish, with the traditional eloquence, earnest and sincere in all things, those of us who have worked for and with Pat have realized what a pleasure it has been to share in his whole-hearted and unselfish endeavours in the interests of his fellow undergraduates.

And so at this time of graduation all School joins with us in saying —Au revoir, Pat, may success and happiness be yours wherever you may go and whatever you may do.

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# SOME'AT ABOUT THE ALUMNI

The Engineering Alumni Association came into being as the result of the 1919 Reunion that gathered in many of the men who had been for several years active in the various local associations that existed in the larger centres.

Why an Association? It is generally appreciated that there existed among School men a "camaraderie" and good fellowship that is developed to a degree more marked than is general in large transient groups of men. Undoubtedly and very evidently this spirit of bonne entente is the result of a common regard for some thing that, for lack of other descriptive phrase, we call the Old Red School. This does not mean the red brick building and frankly does not mean the staff, nor the so often maligned courses of instruction nor only the sports and episodes that go to make up the happy memories of college days, but it is the "tout ensemble" of these things that may be known as Alma Mater. And Alma Mater commands a regard from School men for all the years after they pass out from her portals. The big family likes, as families do, to hang together and keep in touch, and an association of Alumni was deemed advisable to foster this desire to get together and stick together and to help, where possible, our Faculty, our University and our fellows in the profession. The Association was formed, it has flourished, and with the natural growth of two or three hundred a year that each new graduating class is bound to give, it should grow into a strong active organization.

Opinion is divided in regard to the possible work of the Association, some of its members holding that it cannot be more than a social affair designed to hold together School men and to foster School spirit. Others believe that it can be an active factor in engineering education at Toronto; that in time it may lend valuable counsel and aid to the Faculty and University and in future years may lend some financial assistance to special projects, and many members of this mind feel that the Association cannot continue to live unless it can accomplish some useful purpose.

The work the Association has interested itself in to date includes both phases. It has organized and pulled off Annual Reunion and it has interested itself in and offered counsel and assistance in government investigation of University affairs, in the projection of new and needed courses, in the employment of undergraduates and in many incidental affairs of graduate and undergraduate interest.

The future of the Engineering Alumni Association is bright and it welcomes the advent of the Graduating Class of 1923—hopes that this class will add another strong and interesting group to the Association.

C. E. MACDONALD,'18.

# THE ENGINEERING SOCIETY ANNUAL DINNER

Transcending all previous affairs the 33rd Annual Banquet of the Engineering Society in the Great Hall at Hart House has left a memory not soon to be eradicated in the minds of all those who were present on Wednesday evening, Nov. 15, 1922. Food unexcelled, music par excellence, beautiful decorations, witty and interesting speakers, toasts, boxing bouts and burlesques all contributed to make a perfect evening.

Dean Mitchell started the ball rolling by saying grace. When all were seated the famous School quartette beautifully rendered some folk songs. Song sheets containing the latest "hits" were passed around and the hall was filled with the music of nearly a thousand voices. The interval between the first and second course was occupied by the charming rendition of that beautiful lullaby, "Sleep Kentucky Babe," by the quartette.

The first toast was to the King. The President of the Society, in his opening speech said that his remarks should be brief, and illustrating his point likened his remarks to ladies' skirts, they should be short enough to be interesting and long enough to cover the subject.

R. G. Morrison, of the graduating class, proposed the toast to the University, and the President of the Society introducing Dean DeLury, who was to respond to the toast, in view of the absence of President Falconer, reminded him that everything approached a limit. In responding to the toast Dean DeLury proposed that the members drink to the President.

While passing through the Rocky Mountains Dr. Coleman's train stopped for a short time, allowing him and some of his fellow passengers to take in the view, and they were greeted with a welcome "Toike Oike" coming from somewhere among the rocks. In his travels he has come upon graduates of School in every quarter of the globe and further, he went on to say that should he ever go on a geological survey to the Antarctic regions he would expect to hear the same irresistible "Toike Oike."

In proposing the toast to the Faculty, Mr. J. M. Dymond showed that the outstanding feature of S. P. S. was that it had spread. In looking a long way forward to the 50th anniversary he suggested that it should take the form of a huge reunion with exhibitions and theatres showing what S. P. S. had accomplished in the past. These, he said, would act as a great inspiration for the future.

Replying to the toast of the Faculty, Dean Mitchell made some amusing references to the menu card of the 11th anniversary, stating that he was a freshman at the first dinner. He then went on over the old days when Dean Galbraith and Dean Ellis were living. He hoped their memory would ever be green. He gave as an example of our progress here in Canada the difference between the old "sewing-machine" engine he had seen at Port Hope in the early days and our huge modern locomotive. He spoke of the far greater opportunities we had to-day than those of thirty-three years ago. "We are just starting in Applied Science," said the Dean, and he went on mentioning the myriad problems that to-day are still unsolved. Among others were: the national railways problem, good roads, the long distance transmission of electric power, heating, development of oil in the West, and the Radio problem, which are still in their infancy.

Mr. MacQueen gave a solo.

The toast to the profession was proposed by A. M. Reid '23. He spoke of the necessity of raising the status of the profession by law, saying that engineering was dynamic, not static, and he deplored the lack of representatives in legislative and arbitration boards.

As Professor T. R. Loudon rose to reply to this toast he was greeted by clapping of hands and many an approving voice. He stated that the registration of engineers was a stepping stone to further legislation and he showed that "the demand for technically trained men is unlimited" and that there was no fear of engineers being a drug on the market.

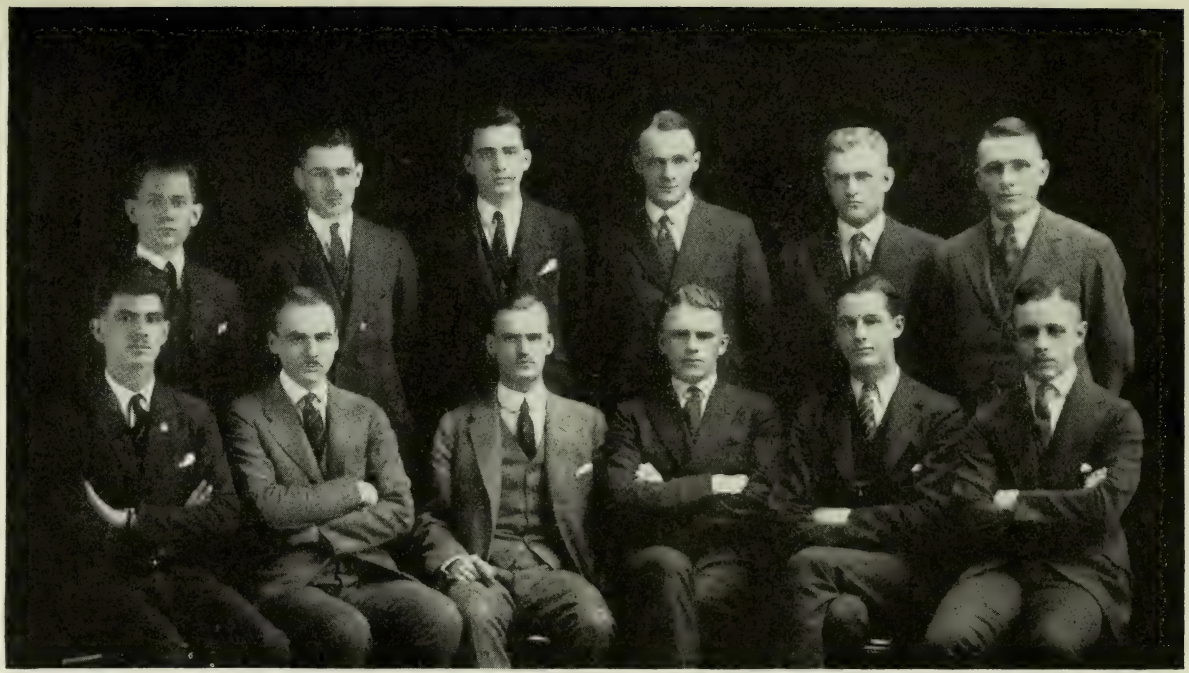
A toast to the Sister Societies was proposed by H. E. Morris of 2T3, saying that we were all engineers. He wished every prosperity to the societies.

Mr. Dingman of R.M.C. replied, representing R.M.C., McGill and Queen's, in a very smart and attractive fashion vaguely reminiscent of the army.

In an absorbing three-round boxing bout, Maguire vs. Seaborn, drew even.

Mr. Grace, an entertainer, gave some very amusing impersonations. Then followed the hit of the evening when a burlesque bout was fought between "Chatson Hamilton Wright" and Jerusalem Rebekka Cockburn; at the end of three rounds it was a draw. But on overtime Chatson defeated Rebekka by poking him one in the jaw, laying him out for a count. The President of the Society then declared the banquet over and the members dispersed carrying with them a greater love for the Old Red School.

C. A. Norris.



S.P.S. DINNER COMMITTEE.

TOP ROW:—F. J. Wallace, C. F. Cockshutt, E. G. Davies, C.B. Macqueen, C. M. Boyer, N. E. McPherson.
BOTTOM ROW:—C A. G. Wade, T. W. Jackson, C. A. Norris (Chairman); F. J. Lyle, V. D'e. Strickland, W. D. Jewett.

# THE ENGINEERING SOCIETY ANNUAL AT HOME

"On with the dance," said the School men on Wednesday night, January 17, and on with it they went. The unparalleled success of the Annual At-Home of the Engineering Society makes it stand out as a social event which beggars description. Each man who had been lucky enough to obtain one of the 350 tickets available appeared resplendent in evening dress; he may have forgotten his programs, or his ticket, but one thing he did not forget and that was to be there and to have "her" with him. And Oh what a sight it was! Did some one remark that the School man was backward in social affairs? Let him read these words and forever hide his face.

Promptly at nine o'clock the expectant couples were received by the patronesses, Mrs. C. H. Mitchell, Mrs. C. H. C. Wright, Mrs. P. Gillespie, Mrs. H. E. T. Haultain, Mrs. J. W. Bain and Mrs. T. R. Loudon, while Mr. Todd bade his band of associated worry banishers and jazz syncopaters to commence their feats of musical excellence.

As if by a miracle the sumptuous Crystal Ball Room of the King Edward was filled with a multitude of joyous dancers. Bumps were exchanged with the greatest of good nature, for though the ball room was large so also was the crowd. And the moon wa!tzes were enjoyed to the nth decimal place. The freshman who had never been at an event of this kind ceased to worry whether his ready-made tie was on straight and entered into the spirit of the dance. And some there were who, perhaps a little wearied, sought quietness far from the eyes of patronesses in the secluded spots specially provided for "sitters-out" and for which the Eddie is famous. And as if to throw more light on the situation the spotlight singled out would-be Vernon Castles—now one and now the other, with its multicolored beams producing over the whole hall a Kaleidoscopic effect intriguing in its splendor.

Then too there were the butterflies, not real ones but ethereal creations which floated along the walls in a never-ending line. How they were induced to be present is a mystery but that they were beautiful is a fact and that they were there is also true.

In the first half of the evening a diversion was provided by Miss Le Barnes and Mr. Mosher, Jr., who offered a special exhibition of dancing in a most pleasing manner. Their interpretation of the latest ball room dance, "The Bandolero," was particularly well executed and was applauded heartily.

After lunch many innovations were introduced and perhaps the most unique of these was the "Doll Dance." For this absolutely new and orig-

S.P.S. DANCE COMMITTEE.

TOP ROW:—H. E. Stewart, L. F. Stokes, H. N. Baker, G. A. Murphy, J. W. Pearson.
BOTTOM ROW:—W. E. Carswell, H. J. Coulter, C. A. Norris (Chairman); F. J. Lyle, A. M. Johnson, C. T. Sharpe.

inal feature some 25 dolls were "broadcasted" amongst the dancers. These were to be passed from one to the other and when the music stopped the couples holding the dolls were to retire from the dance, passing on the dolls to others. By this elimination process finally 25 couples would be left on the floor and they would be the winners of the dolls. The introduction of this dance brought about great excitement and though not following out to the letter the rules of the dance it was obviously a huge success.

A most delightful feature of this part of the dance was the impromptu dance specially given by Mr. R. B. Kerr and his partner. These young people showed real talent in this line and their dancing was highly appreciated.

All too soon came the hour for departure, but promptly on time the last dance was played and the gay dancers regretfully, though with the knowledge that "all things must end," betook themselves towards the check room and thence homewards.

C. A. Norris.

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# SCHOOL NIGHT AT HART HOUSE

School Men, otherwise known as members of the Engineering Society, made a distinct name for themselves in the past term by virtue of the fact that they staged the first attempted innovation of its kind—"School Night at Hart House." For the benefit of all and sundry who were not fortunate enough to attend this unique function, a little explanation of the same might not be amiss.

First, for the reason. As is pretty generally known, the halls of Hart House are above all else open only to men students. When members of the weaker sex—to use a much hackneyed if doubtful phrase—do obtain admission within the sacred portals, it is to attend some one social function, a dance or perhaps a recital. As a result they see Hart House only as a Dance Hall or a Concert Hall. Besides, of course, on specified Sundays, the proud student may show lady friends through the house. "We can swim here," says he, as they pass the tank—or "We read here," as they pass the library. "It must be *wonderful*," says his fair partner, but since in practically none of the parts of the building are any activities in progress, said fair partner rarely appreciates the real possibilities of Hart House.

"This must not be," said the School Men. "We will devise a plan whereby our lady friends may view Hart House 'as is.' They must see all the departments in action—even from the rifle ranges to the library."

Pat Lyle, assisted by his Engineering Society executive, as well as by many other willing souls, racked his brains for weeks to devise a plan with a result which was startling, successful, and unique.


"The Shriek"

January 29 was the night set for the glorious event and 7.30 was the zero hour. Every School Man received admission free, and besides this a considerable number of graduates and friends of the School Men were the happy recipients of the precious pasteboards without which it was futile to enter the building that night. The total attendance was about 2,000, or 1,000 couples—need it be said that Hart House had the appearance of being very much alive?

As was the intention, all departments of the House were "wide open." As a result of laborious efforts, three performances of a notorious play called "The Shriek" were given in the Theatre by an all star cast. Digby Wyatt as the Shriek deserves special mention, while Teddy Huggins and Johnny Dumbrille, as the worthy surveyor and his assistant who attempted to rescue "Neuralgia," the distressed damsel, from the hands of the Shriek, played their part to a nicety. Needless to say that Ralph Kerr made a realistic "damsel" whose signs of distress were only too evident. Pete Culliton made a very affable announcer, giving some few necessary explanations at the beginning of each scene. The fact that the lions refused to eat the surveyor when so bidden, proved an insurmountable difficulty, however, which, in every case, precipitated the end of the performance. The Shriek was, however, appeased with a lollypop, and at the end of the last performance the lions were slain and given to the surveyor to eat, since their period of usefulness was over.

But to show Hart House in full swing was not enough. A noisy, enticing, and get-together midway was to be seen and heard along several of the corridors on the main floor. Here Prof. Humbug astonished thousands with his marvellous transformation trick — Pooki performed wondrous mind-reading feats, while Barney Google displayed Spark Plug to curious spectators.

Each department of the different years ran a side-show and the frenzied efforts of the contending barkers were rewarded by enthusiastic crowds who packed around the centres of interest, straining every muscle to win the coveted lollypop or box of chiclets.

Besides the Midway several important and more serious entertainments were in progress at different periods throughout the evening. There were swimming and water polo exhibitions in the tank, basketball games, fencing, boxing and wrestling matches in the gyms. and shooting competitions in the rifle ranges.

The Toike Orchestra provided an excellent programme in the Music Room, whilst Professor Benson gave an exhibition of billiards in the Billiard Room. In the Sketch Room, a fine selection of works by C. W. Jeffries formed the chief attraction.

Then, that none should feel the pangs of hunger, "Hot Dawgs" and Coffee were obtainable in the Great Hall at the nominal rate of 5c per item. The mustard for the dawgs was thrown in gratis. This small

outlay—20c—for she was usually too excited to eat more than one, constituted the sole expense to the wary stude—a remarkable fact indeed.

At 10.30 dancing commenced simultaneously in the Great Hall and the Little and Big Gyms. Bill Turner's Orchestra provided the necessary syncopation in the Gyms., while Zet Frat's orchestra obliged in the Great Hall. This delightful part of the program capped the climax of a glorious evening and at one o'clock the School Man and his partner, sought their respective check rooms and thence journeyed home. Some were on time at the nine o'clock lecture the next morning and some weren't—but they all had a good time the night before. It is to be noted with great delight that School Night at Hart House now bids fair to be an unusual event. taking its place among our most popular celebration events.

J. F. PEDDER.

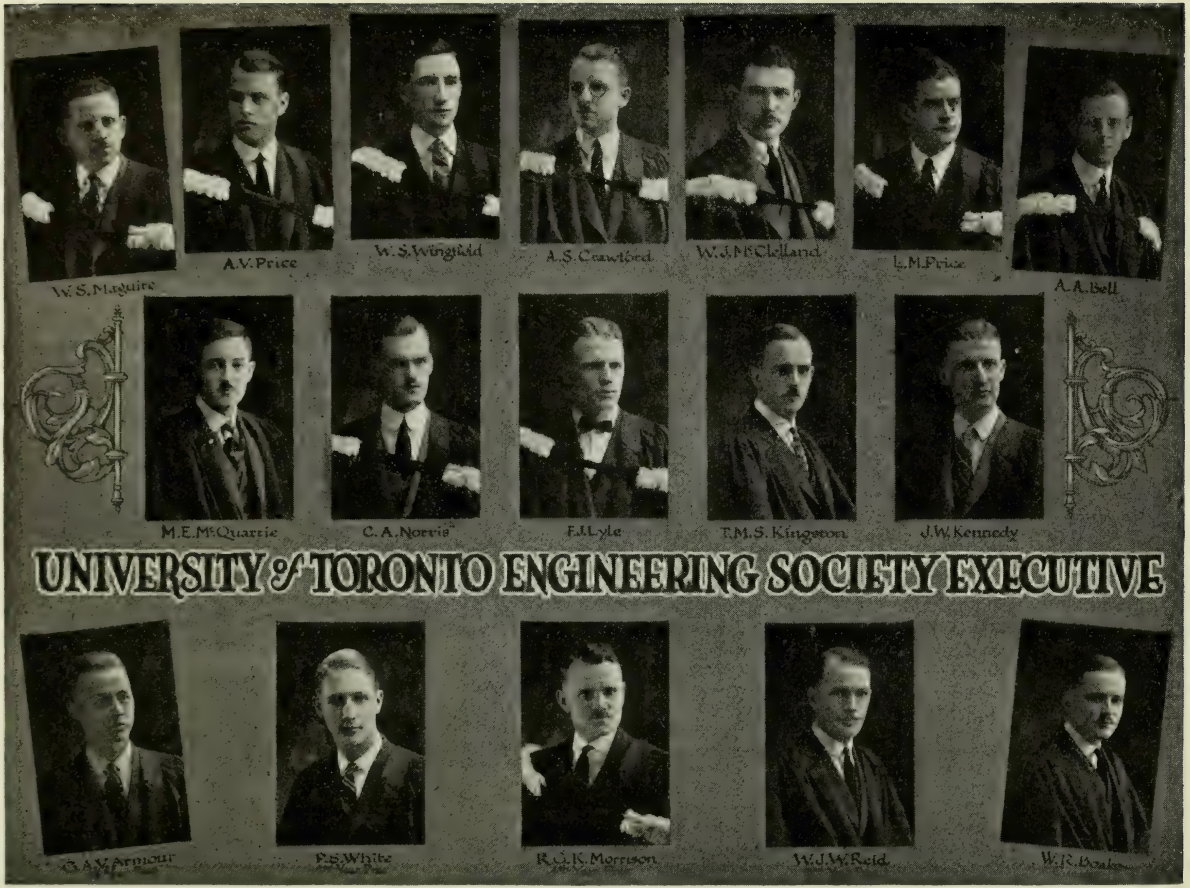
# INITIATIONS

A definite step towards the decision on the initiation problem was made on Friday, Feb. 9, 1923, when by an overwhelming majority a general meeting of the Engineering Society decided in favor of the present system of initiations at School with the sole recommendation that a committee be appointed from Sr. School to co-operate with the Sophomores and Freshmen to assure a smooth running ceremony. While several alternative methods of initiation were proposed, they found small favor and despite the fact that they were excellently presented by their advocates, met severe defeat.

Opening the meeting, F. J. Lyle, president of the Society, spoke of the general growth of opinion throughout the University that the time was ripe for a settlement of the vexatious initiation controversies. He stated that, while the S. A. C. would no doubt draw up a set of rules, as the result of the investigations then under foot, a strong feeling existed that School should battle out the problem for themselves.

Many and varied were the opinions expressed by members of the Society. A few favored a return to the old free-for-all scrap, while another was inclined toward a general University initiation, but no one advocated complete abolition. Some interesting viewpoints were given by members of the Junior Years on the purposes of initiation. The general feeling seemed to be that at the same time as putting the Frosh in his place he should be made to appreciate School and thus unite his year. This idea was enlarged upon together with the opinion that Sr. School should hold the controlling hand and give advice from out their past experience.

After a lively two-hour discussion the meeting placed itself on record by practically a unanimous vote in favor of the present system, leaving in the hands of the Engineering Society executive recommendations towards the mode of procedure in the future with regards to the supervision of Sr. School and the time and duration of the actual initiation and the ensuing social celebration.


W. S. Maguire
A. V. Price
W. S. Wingfield
A. S. Crawford
W. J. McClelland
L. M. Price
A. A. Bell
M. E. McQuarrie
C. A. Norris
F. J. Lyle
T. M. S. Kingston
J. W. Kennedy
UNIVERSITY of TORONTO ENGINEERING SOCIETY EXECUTIVE
G. A. V. Armour
P. S. White
R. C. K. Morrison
W. J. W. Reid
W. R. Baker

# ELECTIONS

School once again surpassed itself in its annual elections. From Wednesday, February 28, until the small hours succeeding the evening of Friday, March 2, all enjoyed themselves; even to the president of the Y. M. C. A., whose words were: "There never was such another night as Friday."

Nominations were held ex consuetudine in the first year drafting room in the roof of the Old Red School. 2T3 enlivened the proceedings by having one man for each position, even to that of Dean, causing much consternation amongst the members of the faculty and the other years. Thursday was spent in violent electioneering campaigns. Festivities opened on Friday with a meeting of 2T3 to listen to the libelous and abusive speeches of fourteen of their number who were running for vice-president of the permanent executive. Immediately after this meeting School gathered in the Great Hall of Hart House where luncheon was rendered exceedingly delightful by some of the various seekers after office with their witticisms. The bill of fare for the afternoon provided for voting and theatres. One theatre party considered themselves lucky in seeing two shows for the price of one. Evening found a huge congregation assembled in the drafting room behind Convocation Hall where, thanks partly to the efforts of the promising M.D.'s of the chemical department, a wild and woolly time was had by all. Numerous motlied games, unlisted in the annals of legitimate sport, were indulged in, punctuated by Pat Lyle and his lantern, broadcasting the results. The grand finale took the form of a real rip-roaring parade which successfully serenaded each and every one of the women's residences and incidentally captured the two iron lions from the front of the Forestry Building. These remained in the possession of School for several days, decorating the steps of the Mining Building.

The elections were appreciated by all good undergrads. of S. P. S. Pat Lyle and his executive, George Langford, and his morality squad were 100 per cent. efficient. All details went smoothly, so much so that parliamentary procedure might well copy.

# Engineering Society Election Results

*President* ..... W. A. OSBOURNE
*First Vice-President* ..... W. E. CARSWELL
*Second Vice-President* ..... G. W. SMART
*Treasurer* ..... J. F. MILLICAN
*Secretary* ..... K. LALLY
*Curator* ..... R. COMPLIN

### Chairmen of Clubs

*Civil Club* ..... W. H. CAMPBELL
*Mining and Metallurgical Club* ..... KEN GRAY
*Mechanical and Electrical Club* ..... H. J. PUGSLEY
*Chemical Club* ..... H. BAKER
*Architectural Club* ..... E. M. COLEMAN
*Debating Club* ..... G. ROWAT

### Athletic Association

*President* ..... R. LAURIE
*Vice-President* ..... C. A. MORRISON
*Secretary-Treasurer* ..... F. J. MILNE
*Fourth Year Representative* ..... B. C. MATSON
*Third Year Representative* ..... S. PERRY
*Second Year Representative* ..... R. K. INNES

## Year Executives

*Fourth Year...*

*President*.....W. A. BECKER
*Vice-President*.....G. ROBERTSON
*Secretary*.....A. R. COLMAN

*Third Year....*

*President*.....H. SMITH
*Vice-President*.....W. J. CAMERON
*Secretary*.....J. W. PEARSON

*Second Year...*

*President*.....D. W. DOW
*Vice-President*.....C. T. NUGENT
*Secretary*.....F. W. BRUCE

## Y.M.C.A. Executive

*President*.....JOHN BEATTIE
*Vice-President*.....H. PAPST
*Secretary*.....H. B. RUGGLE

## 2T3 Permanent Executive

*President*.....A. M. REID
*First Vice-President*.....H. E. WINGFIELD
*Second Vice-President*.....H. B. MORRIS
*Third Vice-President*.....A. A. BELL
*Secretary*.....C. A. NORRIS

## School Representatives on the Hart House Committees

*House Committee*—J. M. DYMOND, W. A. OSBOURNE, FREDERICK WALLIS.

*Hall Committee*—H. S. CLARK, C. S. SNEYD, C. R. DAVIS.

*Music Committee*—F. B. BOSWELL, H. A. GREENWOOD, D. S. LLOYD.

*Billiard Committee*—J. D. BURBANK, V. A. MCKILLOP, E. K. MUELLER.

*Library Committee*—L. C. JACKSON, K. R. SOMMERVILLE, J. A. WILLIAMSON.

# ENGINEERING SOCIETY WEEKLY DOLLAR DANCES

Just a few explanatory words with regard to the recent addition to the social life of School.

For some time there has been the feeling amongst School men of the lack of an inexpensive dance where they may meet under a common roof and be sure of a real social evening without the superstitious fear of too much formality.

When the Engineering Society finally decided to create the Weekly Dollar Dance they felt that they were taking a move in the right direction. In doing this they felt they would bring about a closer relationship amongst the students themselves and between members of the school and staff, and at the same time fill this great need.

Have you ever passed the remark that it is strange the number of men in your own year that you know to see but cannot call them by name? This is one thing we hope to overcome. Besides this, all the Professors have been extended an invitation and up to now several have accepted, and we hope that in the future we will be honoured by the presence of those who have been unable yet to attend.

I think I am safe in saying that it is the general impression that an undertaking of this sort is considered a money-making machine. However, any who have taken part in the production of a Year or School dance realized the fallacy of this idea, and realize, to say the least, that it requires great care to even keep such an enterprise on anything like a sound financial basis.

What our object is, is to give at cost to the students of this faculty, an evening of maximum entertainment, and as long as this is appreciated to the extent of an even balance in the books at the end of the year, the Society will feel these efforts were not in vain.

I might also add that there existed an understanding that this dance was exclusively a School affair. We would like to say that friends of School men are always welcome, as we feel sure that they will help us to keep this dance at its present high standard.

In future we intend adding novelties each Saturday evening, and by watching the ads around School, you can keep yourself posted.

Every Saturday evening you will find the Engineering Society at home at the Metropolitan Assembly Rooms, 247 College Street, between the hours of 8.30 and 12.00 o'clock. One dollar per couple, including tax. Tickets may be obtained at the Supply Department.

The above remarks appeared in Toike Oike in the issue of November 28th. When this appeared, the Engineering Society Weekly Dollar Dance was still in its infancy, and those in charge of this new venture were still labouring under the uncertainty of success. Now, however, that

a year year has slipped by and we can consider this new idea from a viewpoint of results, there is only one conclusion, and that is "success."

In the first place, the financial statement was practically all that could be desired. Here, it must be remembered, that this venture was not inaugurated with the idea of turning it into a money-making machine. The policy, putting it short, was "Most for the least," and the three and one-third per cent. loss on the total expenditure of fourteen hundred dollars, is very satisfactory.

Secondly, the present popular demand for a repetition next year, shows that the popular Dollar Dance is filling that long felt want.

A very pleasing feature this year was the way the members of the staff accepted their invitations, and were seen on different Saturday evenings entering into the real spirit of the Dollar Dance.

In conclusion, we would like to say that the Engineering Society Weekly Dollar Dance, born to reality A. D. 1922, has been a real success, and we hope that it has become a permanent part of School life, as the results of this year show, if nothing else, that it is a large factor in uniting a "big and live Faculty."

R. M. LAURIE, Manager, Weekly Dollar Dance.

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# THE TOIKE OIKE

For the benefit of those who are not acquainted with the past history of the Toike Oike, it may not be amiss to outline a little of it here.

Its first appearance was at the Elections in 1911, the idea originating with Mr. Stiles, '07. On this occasion it appeared on each of the three days preceding election day and contained policies and platforms, the last issue containing photographs of the presidential candidates as well. For the next several years it continued to appear at election time and was considered a very important part of them. During the war, however, it disappeared and was almost forgotten. Then, in 1920-21, Mr. Downie brought it once more into the light of day, making it the official organ of the Society, to appear monthly or at the discretion of the Society. As such it has continued to flourish.

This year Toike Oike has made six appearances. The first issue was in September and was intended principally for the benefit of the Freshmen. The second issue, in October, came out the day before the "Old Boys' Reunion," and formed an integral part of the Society's official welcome. It contained the official program of the Reunion, definite information about each event in the program as well as "School" news which was thought would be of interest to the "Old Boys." The next two issues, in November and January, were perhaps of more particular interest to the student body. The last two issues appeared during election week and

were devoted to election propaganda. The first five issues consisted of four pages, but the last one was increased to six because of the unprecedented demand for space by the enthusiastic candidates.

The aim of the Toike Oike has been to be of greatest service and interest to the student in every way. The various clubs were able to keep their members enlightened as to their activities, present and future, as were also the several years. Every effort was made to keep the Schoolmen acquainted with the numerous branches of sport of School as well as the exact position School held in them. No less effort was expended to keep the spotlight on all social activities both Faculty and Year. In each of these departments the activities were very great and it was only by co-operating with the executives of them that we were enabled to do this. It may have been noticed that the Toike Oike did not print technical papers and treatises. That work has been reserved for Transactions, in order that Toike Oike might remain as a newspaper.

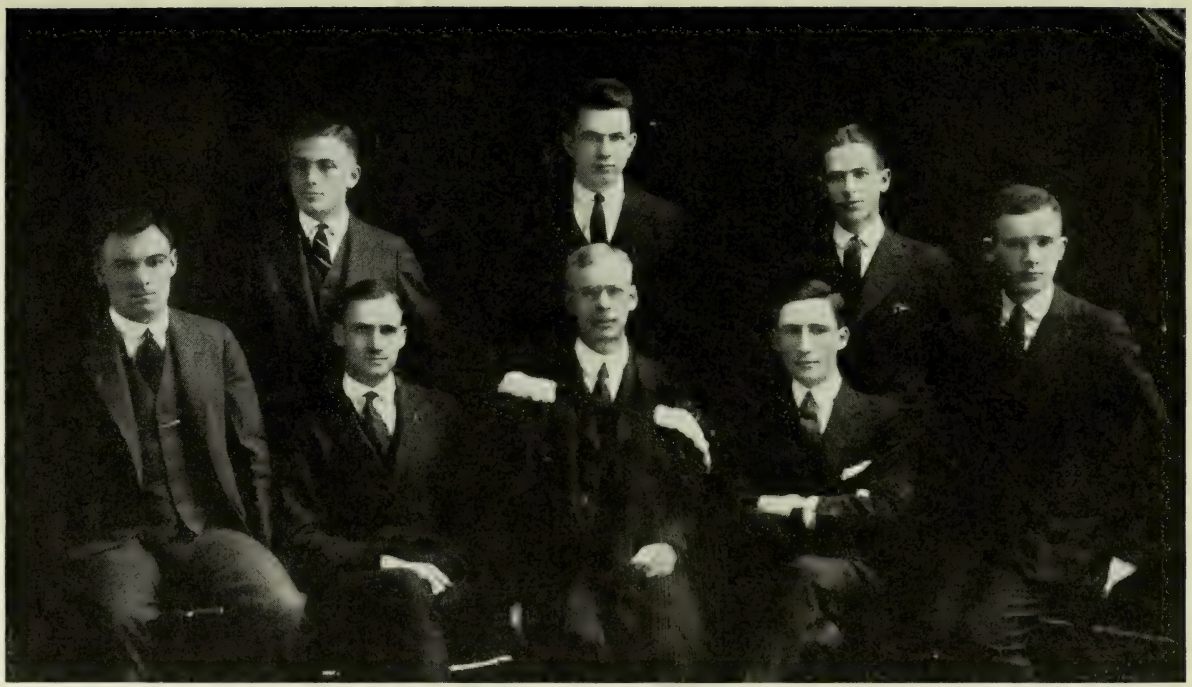
In conclusion, the Toike Oike would like to thank all those who contributed to it at any time and thus helped to fulfill its purpose of service to the student body.

W. R. CHOWEN, Editor Toike Oike.

# THE MECHANICAL AND ELECTRICAL CLUB

The Mechanical and Electrical Club during the School year 1922-23 underwent a marked rejuvenation. On returning for the fall term it was keenly felt that some reorganization was necessary, and the matter was quickly investigated. Public sentiment was tested and at a general meeting early in October three plans were submitted to the members for discussion. The first was to split the club into two groups, corresponding to the two departments. The second was to remain as before, and the third was to enlarge the executive by having a vice-president from both departments from fourth year and two representatives from the third year—one being secretary-treasurer—as well as the president, and the second and first year reps. After much discussion the last plan was finally agreed upon by the meeting. The results have since shown the wisdom of adopting this plan.

The first outing of the Club was a trip to Queenston to look over the Chippawa plant of the Hydro. The party, consisting mostly of fourth year men and accompanied by Prof. Angus, to whom the success of the trip was due, and Prof. Price, left Toronto early in the morning on the Cayuga and enjoyed a splendid trip across the lake. The students were cordially received by the Hydro men, who piloted them through the magnificent power house, which proved a revelation to most of the visitors.



E. & M. CLUB.

TOP ROW: H. J. Pugsley (III Rep.); H. P. Ruggles (I Rep.); R. E. Taylor (II Rep.).

BOTTOM ROW:—J. E. Goldie (Vice-President); W. A. Becker (Secretary-Treasurer); Prof. R. A. Angus (Honorary President); H. E. Wingfield (President); J. G. Inglis (Vice-President).

After a truly profitable visit, the party left Queenston in the evening and enjoyed a real old sing-song and smoker on the way home. This was greatly enlivened by the School jazz orchestra.

The second event was a lecture by Mr. Milne, of the City Works Department, on "Waterworks." The importance of the subject was appreciated by all and the speaker had a splendid reception. To make the descriptions given in the lecture clearer, the hydraulic option of the fourth year paid visits to the pumping stations in the city and saw conditions as they existed in a modern waterworks system.

Several city plants were visited by the other years and were voted extremely interesting and of great help in showing the practical application of the theories learned in the lectures.

The big social event of the season for the Club materialized when a dinner-smoker was held at the Walker House. This was attended by almost two hundred members and was voted a great success. The assembly was honored by the presence of Dean Mitchell and Profs. Price and Angus. The speakers of the evening were Rev. R. E. Knowles, the well-known author, who gave an elevating address on the value of public speaking, and Mr. Wills MacLachlan, the first president of the Club and now with the Hydro.

The spring term was enlivened by a skating party on Jan. 26th, and on Feb. 3rd a dance was held at the Metropolitan Assembly Hall. The following week a highly successful smoker was held at Hart House. Movies and musical entertainment were provided as well as eats and smokes and everyone had a real good time.

Probably the biggest venture of the year was a trip to Hamilton on Feb. 20th to visit four large industrial plants. A special train was chartered and left Toronto at eight a.m., with over two hundred men who, on arriving at Hamilton, divided into two parties and visited The Steel Co. of Canada, the International Harvester Co., The Canadian Westinghouse and the John Bertram plant of Dundas. The evening was spent at the Arena, where the Varsity senior hockey team were cheered and supported as they battled against the well-known Tigers, and the special left Hamilton at 11.30 p.m. with a tired but happy crowd.

The final technical meeting was held in C22 on Mar. 1st, when the Bell Telephone Co. gave a demonstration. The meeting was attended by over three hundred men and was voted as being one of the best of its kind ever held in School. On Mar. 8th the final meeting of the year was held when the new president was installed in office and the affairs of the year completed.

Besides these functions, much work was accomplished that will have a lasting benefit to the faculty. An employment bureau was fostered and final arrangements were placed in the hands of Sir Robert Falconer.

Other student matters were investigated, such as the difficulties surrounding vacation work. Progress was made along these lines toward closer co-operation between Council and students.

The manner in which the members co-operated with the executive was very gratifying. These men saw a real place in School organizations for the Club and sought to realize their ideas. They felt the Club to be the essential link between the theoretical work and industrial practice and every Club member seemed to be imbued with the spirit generated by that realization. A great deal was accomplished this year, but much more can be successfully carried out in the future, but it will call for the closest co-operation between the executive and the members. With this co-operation there is no doubt that the Club will attain and maintain its rightful position as the best Club in School.

H. E. WINGFIELD, President.

# THE INDUSTRIAL CHEMICAL CLUB

Some of our neighbors, to wit, the professors in the Arts faculty, bemoan the fact that the student of to-day is not over-studious. (Of course, nothing is so good as in "the good old days"). It is hoped that this terrible allegation is untrue, but the fact remains that the student in chemical engineering is not interested in technical lectures in the evening. Probably after being exposed to technical and other kinds of knowledge from ten minutes after nine until five o'clock, the poor, would-be engineer craves recreation at night. Recognizing this fact, the executive of the Chemical Club inveigled the members into coming out to fewer smokers this year and with the guarantee that not even the simplest of chemical formulae would be inflicted upon them. As a result, greater numbers turned out at the meetings.

The executive for the year was as follows: Hon. Pres., Prof. J. W. Bain; Hon. Vice-Pres., Dr. M. C. Boswell; Pres., L. M. Price; Vice-Pres., H. N. Baker; Sec.-Treas., D. A. S. Lee; Curator, R. Hayward; Year Reps., IV. H. F. Robertson, III. A. F. Stuart, II. A. Harrop, I. R. K. Innes.

The year was commenced in the customary way with a dinner at the Walker House with seventy-five present. The speaker of the evening was Mr. Beynon, plant superintendent of the Dunlop Tire & Rubber Company. Mr. Beynon gave an interesting talk on rubber.

INDUSTRIAL C IEMICAL CLUB

TOP ROW:—R. E. G. Hayward (Curator); H. F. Robertson (IV Year Rep.); A. F. Stewart (III Year Rep.); R. K. Innes (I Year Rep.); R. C. Harrop (II. Year Rep.).

BOTTOM ROW:—H. N. Baker (Vice-President; Prof. J. W. Bain (Honorary President); L. M. Price (Chairman); Prof. M. C. Boswell (Honorary Vice-President); D. A. S. Lee, (Secretary-Treasurer).

The first smoker was held in C 22 on November twentieth. Moving pictures of Canadian chemical and metallurgical processes were shown, some of which were: "The Story of Paper," "Cane Sugar Manufacture," "Pig Iron and its By-products" and "The Refining of Nickel." During intermissions the musical and story-telling members of the club entertained. A lunch was served at the end of the evening, which was so complete that, it is said, even the freshmen had sufficient.

On the first Saturday morning in December, Dr. Redman spoke to the club. Dr. Redman, the inventor of Redmanol and now general manager of the Bakelite Corporation, talked on the shortcomings of the young graduate and impressed his listeners with his frank remarks.

Owing to a fifty per cent. cut in the membership fee, the club's coffers have not been so well filled as before. On this account, the Chemical Club dance, which has always been one of the events of the social season, but a financial failure, was not held this year. The Chemical Club took over the dollar dance from the Engineering Society shortly after Christmas and all members interested in the terpsichorean art turned out in full force.

The second smoker was held February twenty-second in Hart House. Again motion pictures of industrial processes were shown. At this smoker the music provided was unusually good. Besides the usual numbers from the musical members of the club, N. S. Grant sang, Fred Scott of the M. & E. Club appeared with his banjo and five members of the Stringed Instrument Club entertained very generously. The meeting finished with a lunch in the great hall.

Twice during the School year the fourth year men have been the guests of the Toronto branch of the Society of Chemical Industry at dinner, and for the meeting afterwards. It was through the kindness of Mr. Shoreman, of the British American Oil Company, and Mr. Neighorn, of the Nichols Chemical Company, that the fourth year Chemicals were invited to these dinners. The first was of the chicken variety and proved very delectable. The second dinner was fun at the time, but if the culprit is ever found who put the cathartic in the apple pie, his death will be a slow and a painful one. Dr. Ralph McKee, the head of the department of chemical engineering at Columbia University, spoke after the first dinner. His subject was "Gasoline Twenty Years Hence," and this illustrated lecture on the oil shale industry was very interesting. The second meeting was addressed by Mr. Francis M. Turner, Jr., of the Chemical Catalogue Company, of New York. His subject was "Chemical Plant Equipment." This lecture was the first of a series of six which were well attended.

With the permission of the author, Herb. McManus, and with the assistance of George Langford, of the Miners, the Chemicals are reproducing the "Shriek" for a smoker of the Society of Chemical Industry on March eighth.

The Industrial Chemical Club is finishing the year's activities with a dinner at the Walker House on March sixteenth, at which it is hoped K. S. Maclachlan will speak. As this will be the last meeting of the year, the club will then be turned over to its new chairman, Mr. H. N. Baker.

LLOYD M. PRICE, Chairman.

## THE CIVIL CLUB

The year is drawing to a close, because at this writing we are in the midst of the "School" election campaigns. This is a time for the changes in office, and the shifting of responsibilities. This is also a sure sign of Spring and that the day of reckoning is not far off.

The Civil Club have had a very successful year, and it may be well to give here a resume of their activities since last Fall. The Executive have endeavoured to have some form of gathering at least once a month.

The first meeting of the Club took place in Hart House on the evening of November first. The meeting, which was in the form of a smoker, was preceded by a game of indoor baseball between Civils '23 and '24. Professor Treadgold made an excellent umpire and the game resulted in a victory, to the tune of thirteen to seven, in favour of 2T3. It is rumoured that the 2T4 men should have practised the game harder at Gull Lake instead of being lured away from camp by the night life of Minden. After the game the party adjourned to the East Common Room where Professor Young, who was the guest of the evening, gave a very interesting talk. A Hawaiian orchestra was in attendance and rendered some very fine selections. This was followed by the good old "School" and Gull Lake songs, while the "eats" concluded the programme. About eighty members turned out to this event and a good time was had by all.

The next meeting of the Club was held on the afternoon of November twenty-second, when Mr. Norman MacLeod, president of the MacLeod Construction Company, gave an exceedingly interesting lecture on the "Construction of the Sixteen Mile Creek Bridge." The lecture was illustrated by motion pictures showing every phase of the erection. The interesting point in the construction of this bridge was that the spans used were from an old railway bridge in Eastern Canada. After the piers had been erected the spans were slid into position by means of an overhead cableway. The bridge was about one thousand feet in span and one hundred and twenty-five feet in height. A lively discussion followed Mr. MacLeod's lecture and many instructive details were brought to light. To conclude the programme, two films on Highway Construction were shown. This meeting was largely attended and a good number of students from other departments took advantage of this instructive lecture.

CIVIL CLUB

TOP ROW:—E. C. Shurly (Secretary-Treasurer); F. B. Boswell ('Varsity Rep.); A. F. Hunter (I. Rep.); A. R. Chadwick (III Rep.).

BOTTOM ROW:—W. R. Boake (II. Rep.); W. J. McLelland (President); Prof. C. R. Young (Honorary President); W. H. Campbell (Vice-President); H. G. Clappison (IV. Rep.)

On the afternoon of December the seventh the Club took a trip to Leaside to view the new Durant Motor Company's plant then in the course of construction. Professor Young and the resident engineer were kept busy answering the hundred and one questions of the would-be engineers. The buildings are constructed of reinforced concrete, and cover considerable space. One of the interesting features was the unique and ingenious contracting plant for chuting concrete. Practically all of the concrete on this job was placed by means of a tower and chutes from a central point among the buildings.

By way of a social evening the Club took charge of the Dollar Dance on Saturday evening, December the ninth. The tickets were distributed to Civils only, and as they were limited to one hundred the Club soon disposed of them. Everybody enjoyed themselves and voted it a large evening for a dollar.

Last, but not least, came the famous School Night at Hart House. Here again the Civil Club asserted itself and by way of our contribution to the night's entertainment a photographer's booth was rigged up. The true value of the time spent in the photo laboratory was found on this occasion. Hundreds of photographs of the budding engineers and their sweethearts were taken on this night. The Executive hoped to be able to award a prize to the most beautiful couple. However, after many meetings and much heated discussion we concluded that owing to the great number of handsome School men it would be impossible to award an individual prize to any one couple.

In closing, I would like to thank the Executive for their excellent work, the members for their hearty co-operation and support. At this writing the results of the election are not known, but in any event I know that if any one of the candidates receives the customary whole-hearted support another successful year for the Civil Club is assured.

W. J. McLELLAND, Chairman.

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# THE MINING AND METALLURGICAL CLUB

As the School year draws to a close we pause to chronicle the activities of the M. and M. Club in another chapter of its history.

The opening of the fall term brought together miners and metallurgists who during the previous summer had ranged over most of Canada and part of the States in search of experience for the future and a financial backing for more immediate use.

The first general reunion of the men took place at a smoker in Hart House in October. Here a fund of interesting information was mingled with humor as the embryo engineers told of their experiences—and lack of experience—in the mines and smelters and on geological surveys. Profes-

sor Ellis concluded the addresses by a description of smelter operations in Wales. At this meeting the freshmen were introduced individually to the Club. After proving that they had the moral, mental and vocal qualifications for membership, they were admitted and allowed to sing the Club Chorus.

At the next smoker the Club was addressed by Mr. P. G. Kiely, secretary of the Standard Stock Exchange, on the "Relation of the Stock Exchange to the Mining Industry." This was a very interesting address and called forth much discussion. Mr. Kiely's address, in addition to giving a few sidelights on the financial end of mining, outlined several sane principles of mining finance and investment which, if followed, would tend to minimize the degree of speculation in this class of stock.

Following the holidays, the M. and M. Club in conjunction with the Architectural Club held a successful dance at the Metropolitan Assembly Rooms. The competition in a "Paul Jones" between the two clubs provided an exhibition of unequalled grace. It was thought at first that the Architects, through their familiarity with Grecian art, would have the M. and Emmers at a disadvantage, but so well did the latter acquit themselves in "tripping the light fantastic" that Prof. C. H. Wright, who acted as judge, was unable to decide the winner and called in the goddess of chance, who bestowed the apple on the Architects.

At a meeting of the Club in February, Mr. C. E. MacDonald addressed the members on the "Production of Nickel and Its New Uses in the Industry." This was illustrated by three films on the nickel mines and smelters at Sudbury. The address was very instructive and timely in view of the recent developments in the nickel market.

Throughout the year the members have had access to the meetings of the Toronto branch of the C.S.M.M., a privilege of which many have availed themselves and which we wish to acknowledge. We also desire to thank the officers and members of this organization for their kindness in inviting Club members as guests to their several luncheons, and to express our appreciation of their hospitality.

"———— seeking riches"

MINING AND METALLURGICAL CLUB.

TOP ROW:—

W. Hansen (II. Year Rep.).
J. G. Ironside (Chairman Entertainment.).
J. S. Dickson, (I Year Rep.).

BOTTOM ROW:—

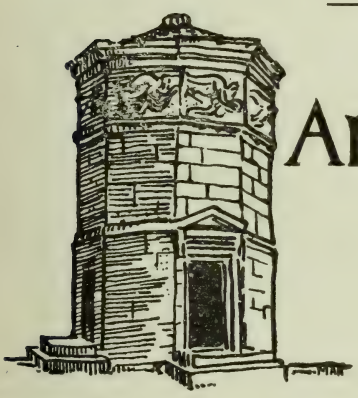
G. C. Mutch (Vice-President);
W. S. Maguire (President);
A. G. Horning (Secretary-Treasurer).

We mention here a departure which, while it has concerned only a part of the Club, has been of great value and is well worth repeating next year. This is the series of talks given each Friday morning to the Fourth Year miners by prominent mining engineers, geologists and mining lawyers, on the development of mining claims and the organization of mining companies. This series of addresses has been arranged by the students. The thanks of the class are due these speakers, who have generously and freely given their counsel and time.

In conclusion, I would like to take this opportunity of thanking the executive for its co-operation and the Club as a whole for its support. In the coming year, K. C. Gray has been chosen chairman, and under his direction we bespeak a successful year.

On behalf of the 2T3 members I wish to bid adieu to the Club. With it we shall ever associate some of the happiest remembrances of our four years at School. We wish it every success in the future.

W. S. MAGUIRE.
President M. and M. Club.



# ARCHITECTURE

"*Every day in every way the Architects are becoming clubier and clubier.*"

With the largest membership in its history and a live executive, the Architectural Club has successfully upheld the traditions of former years.

Owing to the nature of the curriculum, the club is more or less self-contained, and, although the spotlight plays with greater brilliancy upon other organizations in School, the Architects are not so far upstage as one might imagine.

The small membership of the club enables the executive to keep a fraternal eye upon the overworked frosh, the underworked sophs, the can't-work juniors and the won't-work seniors. This promotes a "delightful intimacy" (bring your knitting to the next meeting, Melissa) between the uproarious first year, the laborious second year, the stentorious third year and the glorious fourth year.

The good ship "Double Elephant" having weighed anchor (578.3 lbs. S.R.) and having signed on the following as ship's company, steamed away on her voyage early last October:

Rear Admiral—Mr. J. P. Hynes (Pres. O. A. A.)
Front Admiral—Mr. H. H. Madill.
Captain—A. Scott Crawford, '23.
Mate—Miss J. M. Hall, '23.
Steward—J. D. McLean, '23.
Purser—W. E. Carswell, '24.
Chief Engineer—H. A. McIntyre, '23.
2nd Engineer—W. P. Lawson, '24.
Stoker—F. J. Wallis, '25.
Cabin Boy—G. S. Screaton, '26.

Ensemble—Deck Hands, Look Out, Look In, (Erratum, Etide, "Look In." We didn't have one).

Costumes by J. G. Magee.

Note—In the course of the voyage one soul was washed overboard during a storm.

Within the department is an organization which, although almost totally unknown to the average Schoolman, is worthy of special mention—namely the Architectural Club Quartet. This band of songsters has helped to shorten the tedious hours of night work in the studio and has been heard by numerous nocturnal prowlers who frequent the musty corridors of the Little Red School House.

The first meeting of the year took the form of a dinner at the Inglenook Tea Rooms on Oct. 24th, 1922. There was a record attendance and from every point of view the gathering was a success. After dinner short speeches were given by the Hon. Pres. Mr. Hynes, the Pres. A. Scott Crawford, Prof. C. H. C. Wright and Mr. W. A. Golding. An amusing feature of the evening was the initiation of the freshmen. Each one was called upon to speak for three minutes on a trivial subject received earlier in the day from the sophomore committee. A great deal of originality was shown in dealing with these subjects. Following this the freshmen were taught the Psalm of Life and the Toike Oike under the able direction of Don. Ross.

On Tuesday evening, Jan. 23rd, 1923, the club again met at dinner, this time at Mistress Polly's Tea Place. After an excellent dinner, Prof. T. R. Louden addressed the club on the "Relation of the Engineer to the Architect." His remarks covered many interesting and important points not included in the regular lecture course. The club wishes to take this opportunity of thanking Prof. Louden for the interest he has always taken in the boys and especially for honoring us with his presence at this meeting.

Saturday evening, Jan. 27th, was a memorable night. On this date the "T-square artists" combined forces with the "pick and shovel gang" and staged what both the Architects and Miners claim to be the best Saturday Night Dollar Dance of the year. There was a splendid turnout of

U. OF T.
ARCHITECTURAL
CLUB
EXECUTIVE.

TOP ROW:--

G. S. Screaton,
(I Yr. Rep.);
A. W. P. Lawson,
(III Yr. Rep.);
W. E. Carswell
(Treasurer);
F. J. Wallis (II. Yr.
Rep..

BOTTOM ROW:—

H. A. McIntyre
(IV. Yr. Rep.);
A. Scott Crawford
(President);
Miss J. M. Hall
(Vice-President);
H. H. Madill
(Grad. Rep.);
J. D. McLean (Sec-
retary).

both departments and the great success of the Weekly Dollar Dance was again demonstrated. The feature of the evening was a Paul Jones Competition between the two departments represented. Prof. Wright acted as judge, and being unable to declare a winner on the merits of the dances, he asked the two club presidents to come forward. The latter had to guess the number of keys on Prof. Wright's key-ring. Scott Crawford won out for the Architects and was presented with a large box of humbugs.

Of special interest to the club was the visit early in February of Professor Paul P. Cret, of the University of Pennsylvania. Prof. Cret is probably the foremost architectural designer on the continent and he came to Toronto for a few days as the guest of the university to give studio criticisms to the undergraduates in Architecture. While here Prof. Cret was entertained at the Arts and Letters Club and his address on the gigantic town planning scheme, which he has developed and is now carrying out in the City of Philadelphia, was of great interest to all those who were fortunate enough to be at the dinner. The Architectural Club had planned a dinner and theatre party in honor of Prof. Cret, but he was unfortunately forced to return before the date on which this social event was to have taken place. However, much good was derived from Prof. Cret's visit and the only regret was that he was unable to be with us for a longer period.

Early in April the Annual Exhibition of the Architectural Club will be held in the Sketch Room, Hart House. Preparations are already under way for this display of the work of the department. This exhibition is becoming one of the annual institutions of the university, attended not only by the undergraduates of all faculties, but by the members of the profession and many friends of the university. Full announcements will appear later in the Varsity, and everyone interested is cordially invited to attend this exhibition and become better acquainted with the work done in the Department of Architecture.

Later in the term the annual election of officers of the club for the session 1923-24 will be held. On several occasions this event has developed into quite a party. However, we will make no predictions for the current year. Suffice it to say the best traditions of election day in the Architectural Department will be upheld, including the bonfire.

The executive is arranging to hold a "bang up" social function to top off a very successful year. Many suggestions for this affair are under consideration and at present no official statement can be given out regarding the form the celebration will take. However, the affair will maintain the high standard of all School functions and will doubtless be one long remembered and in a class with the Graduation Dance of 2T3.

In conclusion, the president desires to thank the members of the executive for their valued assistance and enthusiastic co-operation in carrying out

the work of the year. Thanks are also due to every member of the club for their support and for the way in which they attended meetings arranged by the executive. May we take this opportunity of wishing the incoming president and his executive every success and the abundant support that we have enjoyed this year.

A. SCOTT CRAWFORD, President, Architectural Club.

# THE SCHOOL DEBATING CLUB

The Club has endeavored during the last year to create more interest in debating generally throughout the school, and has met with real success. It has not only shown to the Schoolmen that they need not feel outclassed by the more purely cultural faculties, but has shown that the debating talent at the School of Science is equal to that of any.

The year's activities were started with one of Professor Greave's very instructive and entertaining talks on "Some Principles of Public Speaking." Professor Greaves showed the Club how they should control and use their vocal organs in speaking. A successful speaker needs much practice to properly develop and use the voice. Five other meetings were held, all taking the form of debates. The first and fourth years were winners in the first round of the Inter-year debates, and in the final round the first year defaulted to the fourth.

The Club met unparalleled success in Interfaculty debating this year. The eloquent theologians of Wycliffe yielded to the sound judgment of Messrs. Rowat and Emerson in the first round. In the second round W. Osborne and J. Dymond proved to the university that the Science Faculty was not inherently less able to debate than University College. In the semi-finals Messrs. Murray and Price, although not able to defeat McMaster, showed that Schoolmen were very worthy opponents of the premier debating college of the university. Mr. John Dymond very ably represented the university in the Inter-collegiate series, which was won by Varsity. His eloquence and forceful debating style drew great commendation from all those who had the privilege of hearing him, both at Toronto and Montreal.

At the last meeting of the Club executive it was unanimously agreed that one of the difficulties in arousing interest in public speaking and debating in S. P. S. was the fact that S. P. S. students will not talk in public purely for the sake of talking. Discussion purely for the sake of discussion outside of laboratories is not entered into with any enthusiasm. In view of this fact, the executive recommends that as well as the scheduled debates and an occasional speaker on some phase of public speaking, the Club should work with the five departmental clubs and hold five joint meetings throughout the year. For these meetings the program of speeches and discussion should be supplied entirely by the students themselves. In

SCHOOL DEBATING CLUB EXECUTIVE.

TOP ROW:—

R. E. Knowles (1st Year Rep.); N. E. McPherson (2nd Year Rep.); A. F. Murphy, (4th Year Rep.).

BOTTOM ROW:—

S. L. Grenzebach (Secretary-Treasurer); Prof. E. A. Allcut (Honorary President); A. V. Price (President); G. H. Ro t (3rd Year Rep.).

this way topics of common interest would be debated and discussed, and the aim of the departmental clubs to increase interest and knowledge in their particular branch of engineering and the aim of the debating club to foster and develop speaking in public would be realized.

The executive also realized that the work which the debating club is endeavoring to do, that is, to teach and develop public speaking in the Faculty of Applied Science, is in reality endeavoring to add another study to the curriculum. This is done because it is felt that those in authority do not supply the instruction for this branch of our development. The executive feel that a large portion of this work could be much better and more easily accomplished by the faculty instead of by a group of undergraduates, and benefit not a few but the whole school. Speakers addressing the students are continually stating that one of the most important attributes for a good engineer is to be able to clearly express himself in a pleasing and convincing manner in writing, in discussions, and in public speaking. These speakers also emphasize the fact that many of the details in the course considered important at the time will be entirely forgotten after graduation, but any training such as in the proper use of the English language under all circumstances will always be of great value. Many students at present in S. P. S. are at a loss to know, if these speakers are correct, why the faculty do not make a more definite attempt to develop in the School of Science a greater appreciation for the proper use of good English, both written and spoken.

A. V. Price, President Debating Club.

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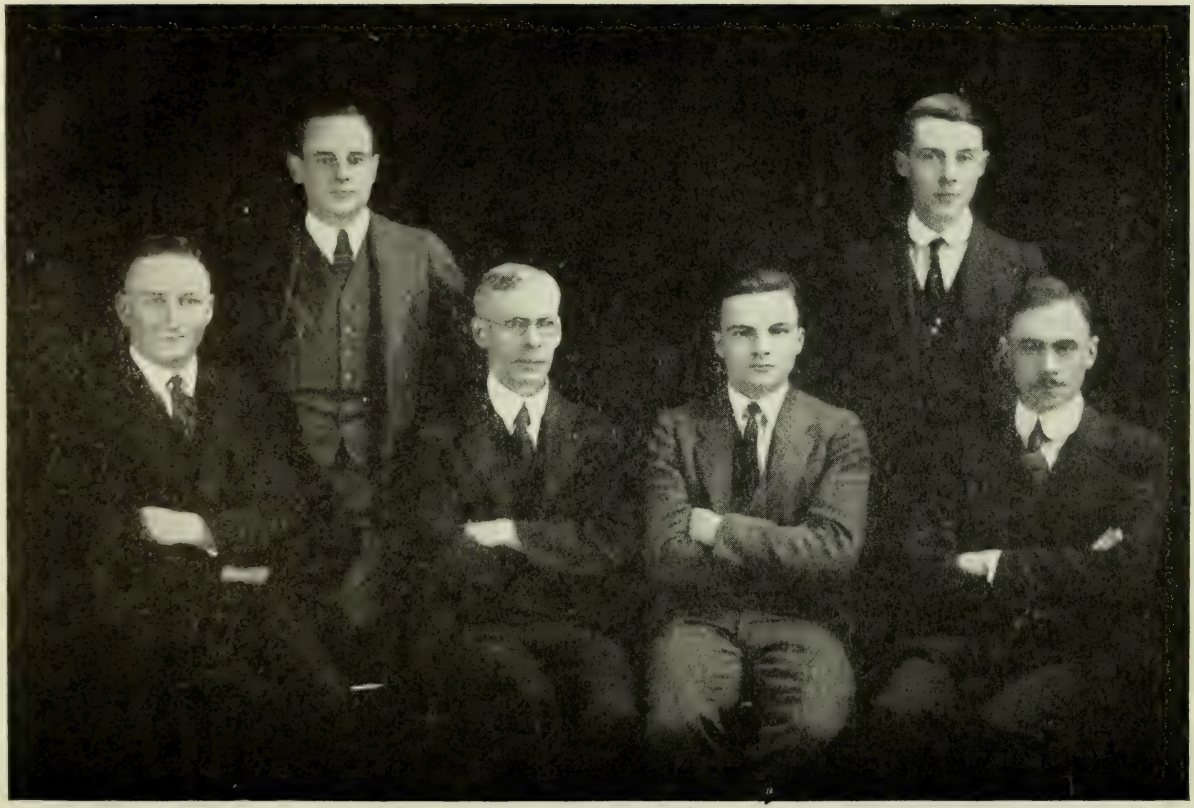
# SCHOOL Y.M.C.A.

The first, and one of the very important events of the year, was the "Frosh" reception. Due to the efforts of the committee in charge, the affair was a decided and joyful success. The main purpose of this gathering, to make the freshmen feel at home and to acquaint them with some of the more important men in the senior years, was certainly fulfilled. The entertainment, put on by the freshmen themselves, was enjoyed by everyone and much undeveloped talent was uncovered.

The handbooks were distributed through the "Y" organization as usual, and were better than ever.

The various committees carried on their work as usual and were very successful.



S.P.S.
Y.M.C.A.

TOP ROW:—

G. W. Smart (Campus Service);
T. H. Jenkins (II. Year).

BOTTOM ROW:—

J. Beattie (III. Year);
Prof. R. A. Angus (Honorary President);
J. C. Dumbrille (President);
A. M. Reid (I.R.C. Committee).

Tony Reid's child—the International Relationships Committee—had a very interesting and successful year. Many papers were read and discussed and the results, while not commeasurable in actual monetary value, were certainly of immense benefit to those taking part.

The Y. M. C. A. took up the Students' Conference which was held at Xmas this year and we had a representation of ten men there. This conference was the first of its kind and was interesting to everyone; but any description of it would be superfluous as the Varsity has described it in detail.

On the whole we had a successful year and I am sure can look forward to better results next year under the hand of John Beattie, the new President. We who are leaving, realize the good we might have done and the opportunities we missed, but we know that our successors have seen our errors and will profit by them. Anyway the new president is a Miner —"nuff sed."

JOHN DUMBRILLE, President.

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# THE ENGINEERING INSTITUTE OF CANADA

The history, aims and activities of the E. I. C. are perhaps known sufficiently well by "Schoolmen" to make any detailed reference unnecessary here. An excellent address covering the subject is contained in last year's "Transactions," should anyone desire such information.

The past year has seen growth in the Institute throughout the Dominion. In co-operation with other societies it was instrumental in having The Professional Engineers Act of Ontario passed last year (1922). While not giving as much protection as was hoped for, it is, at least, a start, and schoolmen are asked to support this new organization and join when their qualifications permit.

During the year there has been a healthy interest shown by students in the meetings of the Toronto branch of the E. I. C. In recognition of this interest the chairman, Mr. Wm. Storrie, set aside a regular meeting as "Students' Night" during the fall term. Papers were presented on "Power Factor," "Overhead Cost-Accounting" and "Refractory Materials," by Messrs. F. A. Ellis, D. B. Strudley and H. F. Robertson respectively. A crowded audience of seniors and juniors was at hand, and the greatest possible appreciation was expressed for the character and delivery of the papers. Students also took part in an informal dinner at the beginning of the New Year, the entertainment furnished by our Hawaiian musicians being received with special enthusiasm.

The council of the Institute has recognized the value of student activities by appointing a Special Committee to report on the best methods of linking up the students with the E. I. C. The fact that Prof. T. R. Loudon and R. W. Downie—both past presidents of the Engineering Society—are serving on this committee insures that suggestions and recommendations will be in line with school sentiments. The other members of the committee are the Chairman, Geo. R. McLeod of Montreal, A. M. Reid and F. J. Lyle, the latter in an advisory capacity. While it is not in order to go into any detail regarding this report, as it has yet to be submitted to the Council of the Institute, it may be safely noted that it is strongly recommended that at no time should a Students' Branch of the E. I. C. be formed in S. P. S. The Engineering Society must at all times have the right of way and retain unquestioned control of undergraduate activities. Nevertheless there is need for a thorough presentation to the undergraduate body of the position of the E. I. C. in Canada, and a greater development of contact through the local branch with the graduate engineers in Toronto. The report deals with methods for accomplishing these desirable ends.

The future of E. I. C. activities in School rests entirely with the student body. There are difficulties in the way, and it may be expected that occasionally, as in the past, the situation may demand tact and caution, as well as enthusiasm. The problems of the Institute are, however, the problems of the Canadian Engineer, and in supporting it as students and after graduation by efforts and constructive criticism Schoolmen will be doing their bit towards advancing the interests of the Profession.

A. M. Reid.


The Class of '23 ('24 Meds) is without a doubt the most unique and impressive class that ever did, and if we may speculate on the future, ever will cross the portals of the University. It is a direct result of the cessation of the greatest conflagration that has ever swept this universe. Four years of youth, who, under ordinary circumstances would have come to University in their respective years, found more urgent things to be done. They did their duty to the end and it was then we found four years concentrating themselves in one and forming the classes of '23.

2T3 Science is composed of men with a wide divergence in age from the old soldier who went over in 1914, to the young recruit and the lads just out of high school in 1919. It is composed, you might say, of men who have held ranks at some time or other, varying from general to that of acting private, without pay, for the younger ones were truly acting privates even if circumstances prevented them from getting the pay.

IV. YEAR EXECUTIVE, S.P.S.

TOP ROW:—J. G. Ironsides (M. & M. Rep.); H. F. Robertson Chem. Rep.); F. W. Huggins (Varsity Rep.); C. H. Lucas (Ath. Rep.); H. A. McIntyre (Arch. Rep.); J G Inglis (Elec. Rep.).

BOTTOM ROW:—H. G. Clappison (Civil Rep.); G. E. McClellan (Secretary-Treasurer); R. G. Morrison (President); Dean C. H .Mitchell (Honorary President); H. B. Keenleyside (Vice-President); J. E. Goldie (Mech. Rep.).

ABSENT:—A. S. F. Murphy (S. A. C. Rep.).

There is much that can be said for our members who, on account of age and disability were not privileged to accept the King's shilling. In our united efforts they have certainly done much in putting 2T3 in the position it occupies to-day, and furthermore, they have shown us that three or four years in the army is not an essential for the making of a man, although it may have its advantages. We started in, in the fall of '19, 401 strong, and three years of university life and examinations have collected their due. Of the 401 that started we have barely 225 left. We have had reinforcements from other years and universities though, and to-day the year numbers 256 men (horse, foot and artillery). Our tremendous casualties are due to all the troubles with which a student is afflicted, from too much social or athletic activity, to that of N. S. F., on which most of us can speak with authority.

Looking on the brighter side of things we who are either awfully lucky or very hard working, or both, have been favoured with associations during the last four years the equal of which we can never hope to encounter again. We have got to know each other and our thoughts, our ways of reasoning and outlook on life, have without a doubt been influenced for the better. We all have our faults and limitations but it is reasonable to believe that by constant association with others who are not afflicted with these particular shortcomings, ours should be reduced to a minimum.

Consider any individual whom you have known from the first year; is there not a great change for the better in him? If he was an extremist in any one line I think you will be bound to admit that he has moderated considerably, or at least developed a tolerance for the other fellow's point of view, which is a great asset to him. Consider yourself, aside from any technical knowledge which you might have accumulated during your sojourn here, are you not an entirely different man from when you began? You can't help but be, even if the difference is of that intangible variety which is akin to a woman's smile.

The Year has among its members leaders in every line of thought and in most lines of human endeavour, that would reflect credit on any body of men (with apologies to Miss Hall).

Our contributions to university activities have been of a highly creditable nature and I can safely say that we have had men taking part in each and every one.

In athletics we have always held our own whether inter-year, interfaculty, or intercollegiate. We have had men on every first team representing the university at some time or other. We are honoured in having in our midst a Varsity rugby captain and an individual track champion, to say nothing of the men who have won T's several times over. In all, we have with us 24 T holders and 58 S holders, which brings our quota above that of any other Year in the University, and their efforts have ever been followed with the loyal enthusiasm which they deserve.

We have had one of our numbers President of the Engineering Society, which in itself is no great accomplishment as one of the fourth

year must needs fill the job to the best of his ability. The distinction comes in having one of our own men fill the job in such a capable, energetic and resourceful manner as our genial, curly-haired friend, Pat, has done, and I wish to take this opportunity to express the admiration and respect of the Year for his successes, which have reflected much credit on us as a whole.

The University at present is governed as Sparta was of old, by two kings, one acting as a restraint upon the other. Representing the kings we have two groups of men, the older element with the reserved judgment of experience, and the younger element filled with youthful vigor and enthusiasm, and possibly a few degrees more rashness. The combination results in a most satisfactory state of affairs; just enough giddiness to satisfy the impetuosity of youth and enough reserve to keep the more stable element from growing prematurely gray haired.

One frequently hears representations as to just what will happen when the older element is removed. Will University life divert towards the side of frivolities and foolishness or will it keep on the level course on which it is at present? From my personal observations I am led to believe that the fate of the University can safely be left in the hands of the junior years, as they have to date shown an adaptability to, and a capability for, managing things which at first surprised most of us.

The Executive this year has done its utmost to keep 2T3 activities up to the standard set by former executives. We assumed that our fall dance held at Columbus, Oct. 26, was an unqualified success as our resignations were not called for immediately afterwards. Our graduation dance at the King Edward, Feb. 22, was aimed to be of that quality which is a fitting climax to the activities of a very remarkable year. As no one has offered much criticism we, the Executive, think we are taking no liberties when we say that it achieved its object. With regard to the graduation dance I wish to express the appreciation of the Executive to that resourceful gentleman who so opportunely pinched the lucky supper programme and let Professor J. Roy Cockburn and his partner, Mrs. Mitchell, down so hopelessly in the elimination dance. Without a doubt it was the most popular event of the evening.

Our permanent Executive will soon be taking over office and we know from experience that they are the most fitting men for the positions, and we can safely trust them to look after our interests in the years to come.

In closing I wish to express my appreciation to the Year in general and the Executive in particular, for their hearty co-operation and energy in executing all things undertaken, in such a satisfactory manner.

The thanks of the Year from when it first entered the University are also due J. H. Brown and M. G. Evans, who have given liberally of their time and skill at most Year functions. In fact I cannot recall a Year dance at which one of them was not officiating as general superintendent.

R. G. K. Morrison,
President 2T3.

# 2T3 "T" Holders

| | |
|---|---|
| Jack Goldie | *Boxing* |
| R. C. Relyea | *Boxing* |
| F. S. Seabourne | *Boxing* |
| A. A. Bell | *Rowing, Track, Water Polo* |
| J. C. Harston | *Swimming* |
| A. Conklin | *Swimming* |
| A. M. Fitzgerald | *Swimming* |
| C. M. Wells | *Swimming* |
| G. Lindsay | *Swimming* |
| H. L. Kennedy | *Hockey* |
| F. Evans | *Hockey* |
| G. G. Duncan | *Rugby* |
| E. Rolph | *Rugby* |
| H. E. Wingfield | *Soccer* |
| M. G. Evans | *Soccer* |
| N. F. Johnston | *Soccer* |
| H. Duffill | *Basketball* |
| C. H. Lucas | *Soccer* |

# Ex-Members of 2T3 "T" Holders

| | |
|---|---|
| A. Carew | *Rugby* |
| F. Sullivan | *Rugby and Hockey* |
| M. D. Earle | *Rugby* |
| Glad Thompson | *Hockey* |
| M. Wolsey | *Gymnasium* |
| J. Smith | *Rowing* |

# 2T3 GRADUATION DANCE

There are dances and dances, but the graduating dance of a notable year is the one which leaves memories which will remain long after the class has gone out into the world. When, for the last time, men who have worked and played together for four full years gather to celebrate the passing of the final milestone, gaiety is tinged with just a little sadness and each moment seems to pass all too quickly.

Such was the Graduation Dance of 2T3 School held at the King Edward Hotel, Thursday evening, February 22. For the brilliance of setting, for completeness of appointments and for a spirit of whole-hearted enthusiasm and good fellowship, the affair was the best of a series which had established the fame of the class in the realm of entertainment. From nine o'clock until three in the morning each hour was crowded with real enjoyment, and such was the excellence of the arrangements that a new standard was set for smoothness in the carrying out of the program.

The patronesses were Mrs. C. H. Mitchell, Mrs. P. Gillespie, Mrs. J. W. Bain and Mrs. T. R. Loudon, and a real honour was paid to the Year by the manner in which they entered into the spirit of the affair. A feature of the evening was the duet by Messrs. Walker and Grant, while the 2T3 quartet entertained with several pleasing numbers. Most striking among a number of original novelties, was a huge black cat mounted in the balcony, from which came a shower of balloons to descend upon the merry makers. Later in the evening bright coloured tickets and whirligigs wer passed around and provided much amusement. Particularly effective was the skilful handling of the illumination and spotlights which made of a gay scene, a veritable fairyland. Supper was served in the foyer, the galley and the sitting-out room, a feature which substantially aided in the efficiency of the arrangements.

The most delightful event of the evening was the elimination dance, which was carried out by means of supplementary examinations indicated on the individual programs. The winners were Prof. J. Roy Cockburn and Mrs. C. H. Mitchell, which caused much consternation among the judges. It was finally decided to give Prof. Cockburn a test in Descriptive Geometry, in which he proved his proficiency by drawing a straight line through any three given points, and was awarded a diploma as third-class stationary engineer.

For their successful leadership of the troops, the three ex-commanders of the 2T3 School Battalion, Messrs. A. M. Reid, A. A. Bell and John Farley, were presented, on behalf of the Year, with gold pencils by the G. O. C., General Mitchell.

The Year Executive, Messrs. R. G. K. Morrison, G. E. McClellan and H. B. Keenleyside are indeed to be congratulated upon the excellence of a dance second to none held before, in the King Edward, or elsewhere,

So was the social life of 2T3 brought to a close and memories of the last dance will come to many whenever their minds turn to thoughts of the Old School.


Last September found many of the class among the missing and the casualties from the spring offensive, but our numbers were increased to almost their original total by another large re-enforcement from 2T3, and by several students from other colleges.

The desire of the class to dance was evident the first week of the term, so Ed. Carswell organized a group who were famous for their work and ideas on dance committees and began planning the decorations, novelties and arrangements for the annual dance which was held late in October in Columbus Hall. The success of the whole evening justified the great amount of work done in preparation and went further to show that 2T4 can stage a dance in which organization, completeness of detail and originality cannot be surpassed. The Year Dollar Dance at the Metropolitan Assembly Rooms in the second term was enjoyed by all, and such a good time was had without requiring any organizing that more dances of this variety may be expected next year.

After the joy killing effect of examinations at the beginning of the second term it was thought necessary to remove this evil effect by holding a real smoker, so accordingly the class assembled in Hart House and, lead by Jack McLaren, of the "Dumbells," displayed mirth and good fellowship which showed they were all good sports and were willing to be the source and recipient of merriment.

The success of a class or a unit in a large university like ours is not wholly determined by the organization and originality of their dances and the pep of their smokers; but greatly by the number of the class who take an active part in Faculty and University activities and sports. A great number of men of 2T4 have become active in various Faculty and University activities, and in sport the Year is as well represented as any. Among these activities 2T4 can be justly proud of the active interest taken by the members in the Debating Society; when they were freshmen a revival of the Debating Society was held and since that time 2T4 has been the main support of that organization in School. This year two

different teams from this class defeated Wycliffe and University Colleges in debate; this and the choice of Jack Dymond to represent the University is a record that any class might well be proud of. In Intercollegiate and Faculty sport the Year was well represented and credit is due to the many men who gave their time and energy freely to bring honor to their Faculty and University.

Considerable success has attended the efforts of the three Year committees 2T4 has had so far, and may the last be more successful. With Fred Becker as President, assisted by Gordon Robertson and Art Colman, the class will complete a remarkable University career.

W. J. W. Reid, President.


The Year did its best to be an exception to the rule but, nevertheless, we lost some men to 2T6 owing to the April shower of exams. There were others also who, may it be said, preferred to graduate belonging to the class of 2T5, in 1922, rather than throw in their chances with the Freshman year. These losses were, however, ably compensated with promotions from 2T4. After all was said and done, we started the year with a strength of a hundred and sixty-six.

The Year first got together at a cracking good smoker in October, and, as the bumptiousness of the Freshmen could not be tolerated any longer, plans were made to give them a good old School welcome in the near future. Bill Turner was in charge of the proceedings and it was largely due to his untiring efforts that the evening was such a success. Under his leadership everyone was given their bit to do at the coming initiation.

The initiation, when it did come off, did not run along the lines originally planned. Nevertheless, it served its purpose, inasmuch as it bound the First and Second Years together with a tie of friendship that could not in any way have been bettered.

In December, at the Carls-Rite Hotel, the Freshmen, as our hosts, tendered us a royal banquet and the evening will long be remembered by all who attended. The members of the year of 2T6, and especially their executive, are to be congratulated on the novelty and wonderful success of the evening.

The next event of importance to the Year was the Year Dance held at the Metropolitan Assembly Rooms under the paternal guidance and chaperonage of Digby Wyatt. Although it is contended that 2T5 are not "trippers of the light fantastic," nevertheless, the "gang" turned out in goodly numbers and two hundred of the Year and their friends enjoyed a wonderful dance.

Credit is due Eric Taylor, Ross Dickenson and Dave Lloyd for the success of the 2T5 booth at School Night in Hart House. The Year ran a game of chance and everybody present either gambled or gambolled at the booth. A grand prize was presented to the winning couple while all those competing were the recipients of lucious lollypops and evidence of their enjoyment was illustrated by the stickiness of the Hart House corridors for weeks afterwards.

Yet another family gathering took place in the form of a smoker under the able management of Doug. Morton. The event happened at Hart House early in February and, with the assistance of Jack McLaren, of the "Dumbells," everyone sang whether they had a voice or not. Interdepartmental boxing and wrestling were features of the evening.

The Year played a prominent part in all Interfaculty and Intercollegiate sports. Twelve Second Year men helped the Junior School football team bring the Mulock Cup to The Old Red School House once again, while the boxers and wrestlers of the Year captured the championship at the S. P. S. Assault-at-Arms. We were also well represented on both the Soccer and Track teams.

As we progress into our third year (and here's hoping we all come through!) the Year gets broken up into Departments and there is danger of the Departments becoming isolated, but, if the Executive are given good support and everyone pulls together, there should be no fear of this. In closing, the Executive would like to thank the Year for the splendid support it has given. With an excellent Executive elected for the coming year there is no reason why we cannot have a bigger and better year than ever.

PAUL S. WHITE, President.

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## 2T6

Everything must have a foundation upon which to build its future accomplishments. It was to this end that the American colonies sought consolidation under the title of the United States and inscribed themselves as "E Pluribus Unum." Surely, when young men gather together from all parts of Canada, from the United States and even the "Land of the Rising Sun," we may truly say that we are met as colonies in a strange land, our cause, education, our bond of unity, a green tie.

As soon as the executive was elected and duly shown its duties by Mr. Lyle, we settled down to business. Initiation was our nearest problem and formed most of the conversation which one heard in the class rooms. As a class we had our ties pulled out and our hats taken off with but a smile of passiveness, until the time came, when to make it gayer for the Sophomores we assembled outside, gave a Toike Oike and rushed into the building for anything and everything. We certainly got everything it seemed, but it took quite a few to do it, so that afterwards we felt one step nearer to being an engineer.

Prior to the big day, the first and second year executives met in the Dean's office, and then things happened fast. The night arrived and so many things took place that only those who attended it can ever fully appreciate what can be done in one evening. The result was that we were treated to a wonderful evening which was brought to a close in Convocation Hall.

In consideration of this attention from our Sophomore year, we then set about to give our best in the most suitable way. The theatres were dumb to our supplications, so that we finally decided to tender a banquet. To this end the committee worked unselfishly, sparing no expense or time. On Wednesday, December 13th, 1922, both years met in the Blue Room of the Carls-Rite Hotel. President Sir Robert Faulkner and Dean Mitchell were our guests of honor and, of course, a source of pride for the First Year. Bill Turner's Jazz Band supplied the music while Mr. Jules Brazil, assisted by some of the original Dumbell cast, an operatic singer and a few comedians, made an evening's enjoyment all too short. I might say that after hearing Red Newman we had quite an epidemic of "Oh, What a Lovely War." In conclusion to the evening Mr. Church gave us a few words and delighted us with his seriousness.

After our Christmas vacation we began to look forward to a smoker, and on Feb. 2nd, 1923, we met in the East Common Room at Hart House to enjoy a real good evening devoid of all frills. Our class orchestra made its initial bow to us and by all appearances it will be a big asset to our year. Miss Complin made *his* debut as a ballet dancer, while wrestlers grappled until black from dusty mats and the boxers bid fair for the Intercollegiate title. The two cannibals, introduced so aptly by Mr. Knowles, fought a fight to the finish, and everyone having eaten to satisfaction showed themselves well pleased and easily repaid the committee for their time.

We have also sought the athletic field, as will be seen from the following names:

*Rugby*—

Varsity Senior O. R. F. U.—J. Carrick.
Varsity Seconds—W. Bentley and H. Irwin.
Varsity Thirds—F. Bruce and N. Scott.
Jr. School—F. Buckland, T. Rogers, E. Burbank, F. Roelofson, R. Complin, F. Sampson, D. Dow, E. Cash, A. Hughes and M. Johnson.

*Soccer*—

Jr. School—C. Armour and L. Barnes.
Interscholastic—C. Armour.

*Hockey*—

Varsity Jr. O.H.A.—J. Carrick.
Jr. School—A. Sutton, J. Auld, E. Allen and W. Bentley.

*Basketball*—D. Dow, F. Buckland, C. Armour, F. Patterson, C. Rogers and F. Roelofson.

*Track*—C. Morrison, H. Ruggle, R. Innes, M. Gooderham and W. Thompson.
*Boxing*—A. Ormerod, F. Hunter, H. Norman and H. Griffith.
*Wrestling*—R. Knowles and K. Gordon.
*Fencing*—F. Barr.

Besides these men, inter-department basketball players are fighting it out for the championship and crests.

We are also on our way to the debating shield and expect to earn it before the year is out. Our first victory was earned by E. Davies and C. Armour against the Third Year.

Owing to the willingness of my classmates to support their executive, things appear to have gotten away to a good start and there is no reason that next year and the ones that follow should not be excellent years of University and Class activities. As for next year, under the guidance of Mr. Dow, our welfare is assured and I wish him every success.

As the academic year closes, and I look back over my friendships in School, it is a source of pride to me to feel how kindly I have been advised by many of our Seniors. Mr. Lyle has done everything possible for me and consequently the year, and Mr. Dymond, who so unselfishly counselled us through the investigation, cannot be forgotten. It is in recognition of such generous service that I offer my humble thanks for my year as a close to our work.

C. V. Armour, President, 2T6.

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# THE TOIKE OIKESTRA

The work of the orchestra was made possible by the Engineering Society providing a piano and the necessary funds for music. The usual enemy, slim attendance at practices, threatened at times, but the custom of holding practices between five and six o'clock and of giving them good publicity helped in this respect.

The School Dinner was the most important event at which the orchestra appeared during the fall term. The universal feeling of good cheer makes it a pleasure to play at such gatherings and this was no exception to the rule. In addition to this the orchestra played at a number of the meetings of the Engineering Society.

"School Night" was the big event of the spring term as far as the orchestra was concerned. Playing in the music room and providing opening numbers for the performances of "The Shriek" kept the members busy until the dancing started.

In closing I wish to take this opportunity of thanking Mr. P. S. Edwards and Mr. G. D. Maxwell for their loyal efforts on behalf of the orchestra.

S. R. Muirhead.

TOIKE O'KESTRA

TOP ROW:—P. S. Edwards, G. A. Russell, A. H. Burke, W. R. Carruthers, G. H. Voaden, W. L. Rundle, J. J McCullough, J. H. Fox.

BOTTOM ROW:—J. Johnson, B. C. Griffith, S. R. Muirhead, (Leader); C. T. Carson (Chairman); W. S. Yates, D. Lloyd, D. D. Flett.

# *School Athletics, 1922-23*

## THE SCHOOL ATHLETIC ASSOCIATION

Every year in every way School is getting better and better. Nothing is more amusing than to hear a group of old, corpulent, bald-headed "has-beens" utter the old cry that things aren't now as they used to be. The average human being is very grateful for this state of affairs. The theory that the scholars are not as brilliant nor the athletes as great as forty years ago must be based on fossilized ideas which have not kept pace with advances. Results and results are proof. Nowadays there are more brilliant men than forty years ago, hence a few don't stand out. In athletics records are continually being broken. Swimming has been revolutionized. Hockey was never on so high a plane—there were not the facilities. Track records are being broken. Skating records are being broken. Rowing has been established in two Canadian universities. Team play in all games is becoming more perfected. The use of brains is constantly increasing in athletics.

School has had an excellent year in sport. Both in championships and sportsmanship, Schoolmen may be proud of their faculty. It is the way a championship is won or lost which reflects on the contestants. In this respect, School stands high.

After a lapse of eight years, Jr. School finally brought home the Mulock Cup. Great credit is due the team and all join in congratulating them. Beattie Ramsay and Don Lee formed a great team as coach and manager. It was very unfortunate that Sr. School was prevented by a misjudgment from entering the finals.

Both the outdoor and indoor track championships were retained, along with the Interscholastic Soccer, the Junior Assault and finally basketball. It is a long time since School won the Sifton Cup. Fortunately it was Jr. School and so the players will all be with us for two more years. Like the rugby, Duffill and Smart turned out a real team. The pleasing feature is that in the other sports, in practically every case, School were runners-up and were eliminated only after a tough fight.

School was well represented on all the Intercollegiate teams. Duffill was captain of the basketball team and Keefler of the swimming team. Varsity, as usual, got its share of the championships.

The executive of the Athletic Association is very grateful to the several managers who all did their jobs faultlessly and to whom much of the credit of any successes is due.

S.P.S. ATHLETIC ASSOCIATION.

TOP ROW:—

F. R. Dickenson (II. Year Rep.);
R. H. Keefler, (III. Year Rep.);
W. A. Bentley (I. Year Rep.).

BOTTOM ROW:—

C. H. Lucas (IV. Year Rep.);
A. A. Bell (President);
K. V. Heyland (Treasurer);
J. G. Cade (Secretary).

It is worth mentioning the record of this year's graduating class. Never before was there such a collection of high-class athletes in one class. A record of 24 T's and 58 S's will stand for many years. The graduation of all these men will leave many gaps to be filled which will call for a strenuous effort on the part of School athletes. However, as long as everyone plays a clean, hard game, the full benefit of athletics will be obtained.

The Athletic Association has a fine new executive. If the students will support this executive whole-heartedly, many more triumphs will be accomplished next year. Let it be everyone's duty to get the freshmen started in athletics while they are freshmen.

A. A. BELL, President.

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# RUGBY

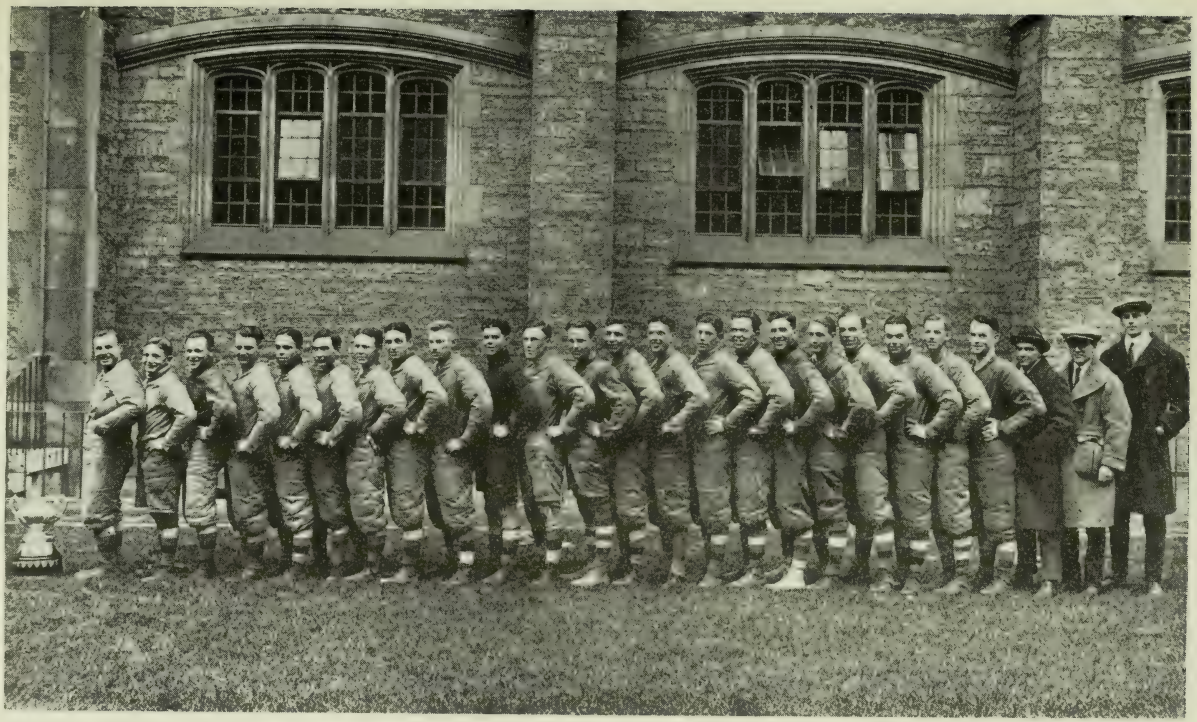
School is back with a vengeance in Interfaculty rubgy. The past season brings back memories of 1915, when Junior and Senior School "fought over the pigskin" in the Mulock Cup finals.

This year Senior School were nosed out by Trinity, due to a little hard luck, an unfortunate decision, not to speak of a fast snappy half line which caught the Seniors napping several times. What Senior School was going to do to the Juniors, if Trinity had not upset the dope, our limited space prevents revealing. However, Junior School have returned the cup where it belongs and we are proud of them. It is the duty of every School man to help to keep it there.

The Junior School team deserves a great deal of credit for their splendid work. Many of their players show great promise and it is to be hoped that some of them will bring further honour to the School by catching a place on the Varsity Senior team.

In 1919 School had eleven men on the Senior Varsity team; in 1920 eight men; in 1921, four men; in 1922, two men. Never in the history of Varsity football has there been a Varsity Senior team without School men represented on the team. Generally, School had the largest majority of men on the team. This spring, the School survivors on the team, Ernie Rolph and Gord. Duncan, graduate. Will the 1923 Varsity Senior rugby team go down in history without a single representative of the old Red School House?

What is to be done? Just this! Let every "School" man who plays rugby, or wants to play, come back next fall in the very best of condition after a summer of outdoor work. Let him turn out to practice with the determination to make that team.



JUNIOR SCHOOL MULOCK CUP CHAMPIONS, 1922-23.

L. A. Booth (Captain); G. B. Sullivan, E. T. W. Bailey, F. R. Dickenson, F. A. Sampson, G. S. Rogers, E. R. Complin, E. A. Cash, G. J. Hughes, F. L. Roelofson, K. F. Parker, H M. S. Pentelow, H. F. Brown, W. G. Lloyd, F. L. Buckland, L. N. Hunter, T. E. Bingham, P. S. White, J. F. Millican, M. H. Johnson, E. F. Burbank, D. W. Dow, W. B. Ramsay (Coach); D. A. S. Lee (Manager); A. A. Bell (President of School Athletic Association).

It will not be on exaggeration to say the result will be that School men of 1923 will uphold the rugby honours which have been set so high in the past by former School men, such as Jack Newton, Hughie Gall, Billy Foulds, Charlie Gage, Joe Breen and many others.

G. G. DUNCAN.

# HOCKEY, 1922-23

Now that it is all over, and we can speak of it in the term of memoirs, it has been, to say the least, a year of hard lost games. From Junior School, Jennings Cup team, to the Varsity 1st team, School men have had once again to show their ever present fighting spirit to combat the misfortune that has followed them all year.

Junior School under the leadership of George Cossgrove were forced to take the ice with little practice, owing to the schedule, and had the misfortune of losing their first game. This fact, coupled with the postponed games which had to be played after the regular schedule when sickness hit the team, left Junior School near the low end of the group standing. Here the youngsters showed their mettle in the fact that although they could not win their group, they made the winners fight all the way to earn their victory.

In Group "A" Senior School and Senior Dents were destined from the first to be thorns in each other's sides. Senior School went through the first part of their schedule without a loss. Then the little "world's series" started with the first game with Dent's which ended in a tie. The next game was a 1-0 victory for Dents. The tie game was replayed with a win for School, 3-2. This made the necessity for another game, and a sudden-death was the verdict. Without a doubt this was the greatest game of the year. Full time found the teams on even terms and even at the end of twenty minutes overtime the score was 5-5. In the last ten minutes the first goal was to decide the game and with both teams nearly dropping from exhaustion, they fought on with all they had. With two minutes to go, Dents secured the winning shot and School left the ice defeated, but with the thought that they had fought their best for School. They were both great teams, and to the pleasure of the School team, Dents finished Jennings Cup champions.

School was represented on all the Varsity teams. Dickenson and Garrick were School's rep's on the Junior team, which was under the leadership of Connie Smythe, a School grad. In the O. H. A. they were defeated in the semi-finals after a hard fight. In the Intercollegiate a very unfortunate incident arose. After defeating R. M. C. in the finals 10-1 without the service of substitutes, owing to a misunderstanding in the rules, Varsity 3rd's had to default the Cup.

SENIOR SCHOOL RUGBY TEAM, 1922.

TOP ROW:—Bert Morris (Manager); A. Conklin, J. H. Coulter, C. Woodburn, J. Goldie, W. Longworthy, C. Sharpe, "Tiny" Houston (Coach).

CENTRE ROW:—L. Kennedy, G. Robertson, K. Hamilton, C. S. Sneyd, E. Baird, O. D. Johnston, G. Beecroft, L. Langlois.

BOTTOM ROW:—C. M. Bowyer, R. Laurie, G. F. Dean, B. Jennings, (Captain); G. Kay, L. Stokes, C. Catto.

ABSENT:—R. B. Kerr.

On the Second team, Kennedy and Willford were on the roll. Both these men showed their skill in senior company several times. Lyle Kennedy had the misfortune to suffer an injury to his face, but after a short rest he was back in the game. The intermediates although losing their group in the O. H. A., won the Intercollegiate.

Glad. Thompson, the quiet goallie, was School's only playing member on the 1st team. Beattie Ramsay and Gord. Duncan coached and managed the team to Intercollegiate champions. Owing to sickness, the team got away to a bad start in the O. H. A.

Gord. Duncan, after a hard rugby season and besides managing the Varsity 1st team, was one of the reliable players on Senior School's Jennings Cup team. We wish to thank not only the men that helped School as players, but also Glad. Thompson and Beattie Ramsay for their services as referees in the Interfaculty series.

R. M. Laurie.

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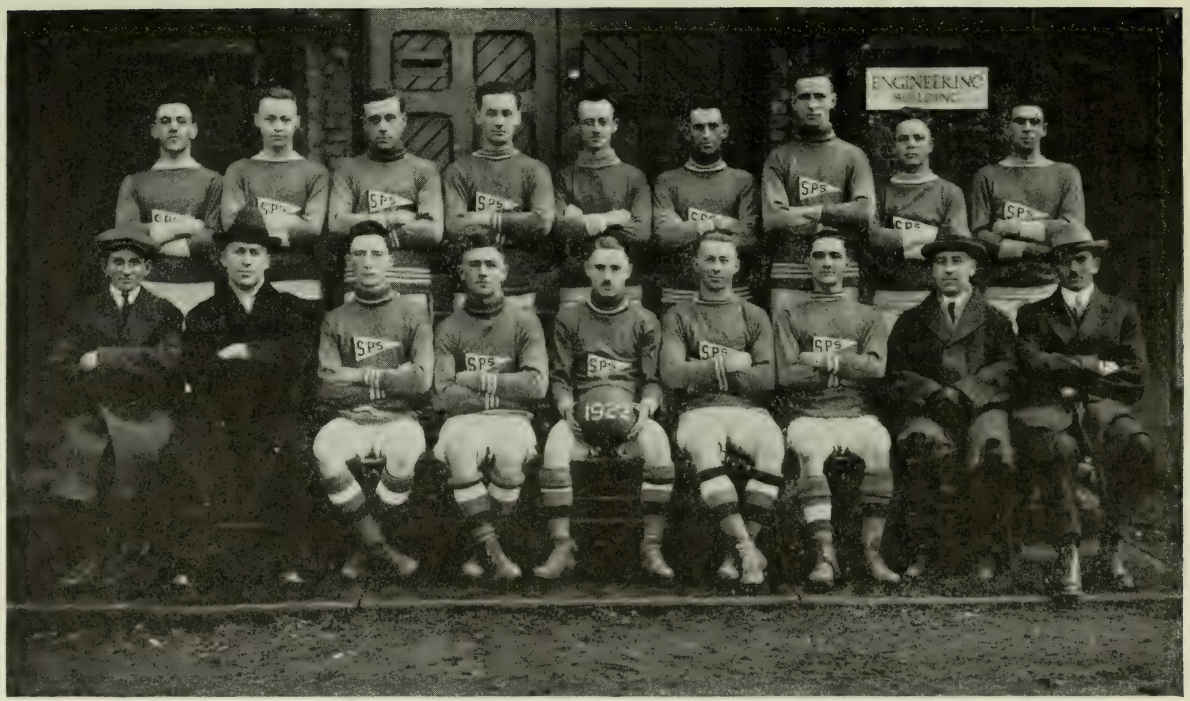
# ASSOCIATION FOOTBALL

Football has had a big year around the University this season, and indications point to a revival of the Intercollegiate Series, which will bring the sport again to its position among the leaders in the athletic world. A most successful tour was undertaken last fall when the Varsity Firsts visited New York, Princeton, Lehigh and Philadelphia. The team won the first game from the well-known Crescent Club of Brooklyn by 7 goals to 0. From this victory they went straight to Princeton and defeated the U. S. Intercollegiate champions by 4 goals to 1. Lehigh University went down by 3 goals to 0 and the tour ended in a drawn game 1-1 with U. of Penn. team, giving three wins and a draw and a total of 15 goals for and only 2 against.

School was well represented on the team in the persons of Evans, Johnson, Smillie and Wingfield. To Evans goes the credit for the remarkably low number of goals scored against the team. They all not only did great credit to their faculty in their efforts in the sporting line, but judging from some snaps floating around School after the trip, they acquitted themselves very favorably in the eyes of the "Belles" on the bathing beach at Atlantic City.

Due to no Intercollegiate Series this year, School entered a team in the Interscholastic Series and landed the championship after some hard-fought games with Meds and Dents, and in the finals with Arts, who had beaten O. A. C. 9 goals to 8 on the round.




S.P.S. INTERSCHOLASTIC SOCCER CHAMPIONS.

TOP ROW:—G. B. Craigie, C. A. V. Armour, G. I. Wilkinson, R. A. Story, M. G. Evans, N. F. Johnston, C. H. Lucas (President); D. L. Melick, T. A. T. Legge.

BOTTOM ROW:—J. H. Browne (Secretary-Treasurer); Prof. J. T. King, (Hon. President); H. E. Wingfield, C. P. Breuls, W. R. Dunbar, (Capt.); J. MacLellan, G. D. Scott, Prof. E. A. Allcut, (Honorary Coach); L. D. Campbell, (Vice-President).

In the Interfaculty Series, School entered two teams, a Junior from the first and second years, and a Senior team from the third and fourth years. There was plenty of material to choose from, especially with the Juniors, who made an excellent showing and promised good for the future. The Seniors were defeated by Senior Dents for the group honors after a very close game, the Dents being later defeated by O. A. C. in the finals.

Soccer will be affected in the same way as all other sports by the passing out of 2T3, but the interest and support of these men will always be given for the sake of their alma mater.

It would not be fitting to close this report without making some mention of the valuable help and experience we have received from the two honorary members of the Club, Prof. Allcut and Prof. King. The former, as Hon.-Coach, has helped us not only in the selection of the teams, etc., but has also been responsible for drawing up a constitution for the Club which will make it much easier for the new executive, with Lorne Campbell as president, to cover the work next year.

The Club is also very grateful to the School Athletic Association in the way they have completely outfitted the two teams, and for their general support this year. It is this kind of co-operation between the Association and the various clubs of the faculty which boosts Interfaculty athletics.

The members of 2T3 wish the new executive and the Club the best of luck in the future, and, by the way, how about a game between 2T3 and School at the reunion next fall? Think it over.

C. H. Lucas.

## TRACK

For the fourth successive year, School has captured the Toronto Cricket Club Cup and also the indoor championship. This is a very fine record and it should be the ambition of every school man to uphold and continue the good work.

Unfortunately we are losing several good men this year in "Art" Bell, G. Langford and Meredith and others, but with such men as Innes, Cade, Turner, Morrison, etc., to carry on, we should not be out in the cold.

Last fall we started a new idea in Track work when a very successful Interyear Meet was held, Monday, October 9th. The individual champion was "Art" Bell, who ran away with three firsts in the weight events. 2T3 won the year championship but 2T5 and 2T6 made very good showings and should put up a great fight next year for the championship.

On the following Friday, "Art" again towered above everybody else with the same three firsts and in these events either G. Langford or Bert Morris grabbed a place also. This, along with the good work of Cade, Innes, Meredith, Turner and others, gave us 50 points with Meds and Dents tied for second place with 24 points each.

S.P.S. TRACK CHAMPIONS.

TOP ROW:—

J. G. Cade,
J. E. Buchan,
D. L. Polak,
R. K. Innes,
W. I. Turner,
G. B. Langford,
H. M. Morris,
A. A. Bell,
H. J. Meredith,
C. A. Morrison.

In the Indoor Meet, School again walked away with things, Evans coming within 1 point of being Individual Champion, with Cade, Morrison C. A. and Pollack running close behind.

Several records went by the board at this meet, among which were the Shot Put by "Art" Bell of 41 ft. On the same day, Morrison C. A. lowered the 220 record by 1/5 of a second to 24 3/5 seconds, and Turnbull made the Mile Walk in the remarkable time of 7 min. 29 3/5 sec., which was 22 2/5 seconds below the previous mark. Evans, 2T3, also tied the 50-yard record for the second successive year in the time of 5 4/5 seconds.

In the Intercollegiate Meet, Varsity did not do as well as was expected, but as usual, "Art" was on hand with two firsts, and the showing of our other representatives from School was very encouraging.

In closing, I would like to wish the members of the Track Club the best of success for the coming years and would like to appeal to some of our strong arm men to turn out next fall to replace the trio, Bell, Langford and Morris, who are leaving us this year. This is not only necessary for the School Team, but also applies to the Intercollegiate Team, which next year will have the best chance of copping the silverware that they have had in many years and on our own track too.

J. H. Browne, 2T3.

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# THE BOXING, WRESTLING AND FENCING CLUB

It has been felt for several years that the Davidson Cup has been too much of a stranger at the "Old Red School." The reason for this is that the sports which this cup represents are not as well supported at S. P. S. as they should be. In a man's faculty, such as School, this state of affairs should not exist.

In order to encourage more interest in this branch of athletics, a School Boxing, Fencing and Wrestling Club was organized last fall. Bob Relyea was chosen as manager to show the boys how neatly it might be done with a right cross. C. L. Brittain, E. B. Hubbard and H. L. Norman were elected to instil the proper spirit in their several years. An Inter-year assault was arranged to secure new material. Men who had won a senior bout or a junior final were barred, so that beginners were under no handicap. A cup was put up which it is intended will be competed for each year.

This School meet was held Dec. 9th, and was successful in bringing out some promising material, besides providing many well-contested bouts. 2T5 won the cup by a good margin with a fine string of boxers and wrestlers.

The winners of these events represented School in the Junior Varsity Assault held a week later. The result was that School had a strong team and succeeded in winning the Junior Interfaculty Championship. This was gratifying considering the poor showing from lack of entries School made in the same contest last year.

In the boxing, Hubbard's performance in the 118 class was particularly good. Toye in the 135 class and Switzer in the 158 class won their finals. In the wrestling School met a doughty opponent in Dents and only took one final, the 175 class, which was won by Jeckell, who defeated his man without difficulty. In the fencing, Grenzeback won the final.

Most of the winners of these two events will be at School for two more years and during that time they have good opportunities of winning further honors for School in Senior events.

In the Assault in December between U. of T. and O. A. C., which the former won, School provided two of the boxers, Bob Relyea and Maguire, who were successful in winning their events.

When Varsity met West Point after Christmas, their boxers were represented in two of the weights by Schoolmen—Bob Relyea and Fred Seaborne—both of whom gave their opponents stiff opposition till the last bell.

In the Senior Interfaculty Assault, School made a strong effort to capture the Davidson Cup. However, this went to the Dents with School and O. A. C. tied for second place.

School's failure to land the prize lay in her lack of wrestling material. What we had was good but there was not enough of it. Before School can make sure of this cup, more wrestlers must be developed. None of the weights should go unchallenged by School. Alex Murray turned in a good performance in the 145 pound wrestling. In the 175 pound class, two Schoolmen contested for this place on the Intercollegiate team, W. H. D. Clark and Jeckell, a bout which Clark won.

In the boxing, Hubbard won the final in the 118 class. "Hub" has two more years at School and it looks as if he could be counted on for this class, not to mention picking off an Intercollegiate championship. He made a good show in trying for it this year.

Bob Relyea won the 125 from another Schoolman, Dave Lloyd. Dave is charging his loss to experience and intends to look after this class next year when Bob has graduated. Bob represented Varsity in the Intercollegiate and drew battlers both nights. He won his first and in the final his opponent's seconds wanted to throw in the sponge after the first round but the McGill boxer insisted on continuing and put up such a game exhibition that the judges gave him the decision.

The 135 class was well represented by School with three men in the semi-finals. Fred Seaborne was forced to withdraw through doctor's orders from the final, which went to another Schoolman—Maguire.

Fred graduates this year and with his departure not only School but Varsity will lose a capable man. Besides being a boxer of no mean prowess, his executive work in connection with the Varsity B. F. and W. Club, of which he has been President during the past year, has added much to its success.

The battle between School's super-heavyweight, George Langford, and Mahon, of St. Mike's, was the event of the Assault. It went four rounds with Mahon getting the decision on points.

A large number of the Varsity Inter-Collegiate team are graduating this year. Here is School's chance to step up and fill the vacancies in the ranks. There are now plenty of opportunities for the beginners to enter the game in the Junior meets and secure experience and confidence for the Senior events. School itself is losing several of its "old-timers" but the men who are left can be counted on to see that School maintains her traditional place—second to none.

W. S. MAGUIRE, Pres. School B. F. & W. Club.

## SWIMMING

That swimming is one of the outstanding sports participated in by the men of S. P. S. is ably demonstrated by the water squad in their rigorous training and by the enthusiasm and support which they have received from School. 1922-1923 is the first year since the Fitzgerald Cup was donated for Interfaculty Swimming that it has not found a resting place in the Old Red School House. University College were returned winners over School by a margin of two points. Our relay team, consisting of Harston, Lindsay, Wells and Keefler, set a new record of 1.50 min., breaking the Interfaculty record by 3 2/5 secs. and the Intercollegiate by 2 1/5 secs. Harston won the 50 yards speed, Fitzgerald the 100 yards breast, and Keefler the 100 yards free style, tying Geo. Lindsay's record of 63 4/5 secs., so, although beaten, we were by no means disgraced.

On the Intercollegiate Swimming Team, School were as usual well represented. This year's meet was held in Hart House and was well attended. Varsity gave McGill the worst trimming they have ever received, the final score being 41 1/2 to 24 1/2. Vernot, of McGill, set several new records, the best of which was the time of 2 min. and 19 2/5 secs. for the 200 yards, in which event Wells swam third. Keefler was second to Vernot in the 50 yards free style, while Fitzgerald won the 100 yards breast stroke. The outstanding feature of the evening was a relay race, when the Varsity team, of which Keefler was a member, hung up a new record of 1 min. 46 secs. flat.

And so School's swimming activities are over for another year, which, although not as successful as others, has added yet another notch to the stick of things well done, but with the passing of 2T3 a gentle warning should go out to the rest of S. P. S. to look well to their laurels in the swimming game because School's teams in this sport have for the past four years been drawn from members of the present graduating year.

C. M. WELLS, President U. of T. Swimming Club.

## WATER POLO

S. P. S. would have had little difficulty in renewing her triumph of the previous year when the Interfaculty series was won without a defeat, but that five men playing Intercollegiate polo were barred from playing with School. A new team had to be built up during the Rugby season when we missed such men as Booth, Kerr, Kingsmill and Murray. On the turn-out of these men a decided improvement was noticed in School's game and we went through the rest of the schedule without a defeat; but it was too late as Junior U. C. had a strangle hold on the cup.

"Slim" Bell, Conklin, Fitzgerald, Harston and Wells played Intercollegiate Polo again this year and helped considerably in Varsity's 4-1 victory over McGill at Hart House. "Slim" Bell played a wonderful game in goal, while Conklin's work on defense was a treat to behold. McGill's 6-0 victory in Montreal gave them the round and with it the Polo championship for three years in succession.

The following fish took part in the University aquatic activities during the year:—Bell 2T3, Conklin 2T3, Fitzgerald 2T3, Harston 2T3, Wells 2T3, Schinbein 2T3, Murray 2T3, Keefler 2T4, Kerr 2T4, Kingsmill 2T4, Coleman 2T4, Hill 2T5, Booth 2T5, Little 2T5.

C. M. WELLS, President U. of T. Swimming Club.

## BASKETBALL

In the past year basketball enjoyed a very successful season at School. School was represented on all the Varsity teams, Captains Duffill and McLean being two of the stars of the Firsts, while Bell and McBride were members of the Senior O. B. A. quintet. In addition to these there was enough talent left to win the Sifton Cup. The Junior School squad followed the example of the Junior School Rugby Team, and accomplished this feat.

The Juniors were a fast, aggressive, well-balanced team who well deserved the championship. They won their group by defeating Knox and Trinity. Knox gave them their hardest battles but Trinity proved very

weak, and in the second game School ran up the record score for this season and perhaps for all time. When the final whistle blew, Trinity was on the short end of a 62-0 score. In the second round, School was grouped with Sr. Vic and Jr. Dents. The Vic team was looked upon as the team to beat, but the Juniors defeated them rather badly in both games and dealt with Dents in a like manner. Sr. Dents were successful in winning their group in the second round and entered the finals against Jr. School. It was thought that the light School defence would have some difficulty in stopping the heavy Dent team but they came through with flying colours. The final score, 25-13 in favour of School, was a good indication of the play.

The team consisted of Little (Captain) forward, Loydd, forward, Dow, forward, Turner, centre, Patterson, defence, Buckland, defence, and Roelofson and Rogers, spares.

The Senior School team was not as successful as the Juniors, as they lost out in their group to Senior Vic. The first game resulted in a 16 to 9 win for Vic, and the second also ended with Vic on the long end of a 16 to 15 score. In both games School had an even share of the play but fell down badly in shooting.

Prospects for next year are very bright. Several of the Senior players are graduating but the majority of the Juniors will be with the Seniors if they do not make one of the Varsity teams. Each incoming first year seems to bring an ever increasing number of high class players, so both the Junior and Senior teams should be just as strong, if not stronger, next season.

W. B. Jennings, Pres. S.P.S. Basketball Club.


JUNIOR SCHOOL BASKETBALL TEAM. SIFTON CUP WINNERS. 1922-1923.

TOP ROW:—

W. H. Duffill (Coach);
F. H. Patterson,
G. S. Rogers,
F. L. Buckland,
F. L. Roelofson,
G. W. Smart (Mgr.).

BOTTOM ROW:—

W. G. Lloyd,
W. I. Turner,
E. M. Little,
D. W. Dow.

# ROWING

The 1922 season was really a most successful one. From the standpoint of trophies or championships, the Hanlan Memorial Trophy, emblematic of the Canadian 8-oar championship, was won for the third successive year. It is true many defeats were suffered by the different crews, but the most gratifying feature is the gradual increase in the number of members of the Rowing Club whose enthusiasm and devotion are unbounded and who will, as time goes on, form the backbone of a fine university club upholding the highest ideals of amateur sport.

By long hours of willing and persevering work much was accomplished. In the basement of the school building, under the able direction of Prof. Cockburn, an excellent working boat, the "J. Roy," was built entirely by the oarsmen and a few good friends. It has given and will continue to give first-class service.

The Parkdale Canoe Club most kindly allowed us to house our boats beside their clubhouse and all other accommodation was found in it. The Canoe Club members certainly were ideal hosts and great friendship grew between the two clubs.

The Rowing Club built a long shack for the shells and innumerable floats to launch from. Unfortunately, the shore there was very unprotected and the greatest obstacle to developing first-class crews was the rough water. Frequently rowing was impossible, and sometimes only by waiting till late in the evening was it possible to get out. Thus, for the final month, July, the three crews raced up and down the lake, each man cursing the folly of his predicament, at the same time unable to resist the lure of "another good ten."

The chief engineer and first mate of the coach boat, Kiota, were most faithful in their work and spent much of their summer holiday trying to make a balky engine stop balking.

The crews spent five days at St. Catharines for the Henley, which is becoming finer each year.

The senior crew went to Philadelphia the following week where they were again nosed out of the Championship of America.

This year the crews will row on the bay. A new boat is coming from England and an excellent squad is turning out.

Although winning trophies is gratifying, playing a game for the love of sport is the aim of sport. For this reason, the Varsity oarsmen are all sportsmen.

A. A. Bell.

# INDOOR BASEBALL CLUB

A School indoor baseball club was organized in the fall to co-ordinate the efforts of the two teams. The officers elected were: Hon. Pres., Prof. Treadgold; President, G. C. Mutch; Sec.-Treas, J. A. Williamson. Eric Taylor and Ray Sirrs were appointed managers of the Junior and Senior teams respectively.

For the third year in succession the Senior School team lost out to the eventual champions in a group play-off. Much enthusiasm was displayed throughout the season among the players, and all gave the best they had. The pitching of Gord. Mutch, and the catching of Dowe were the features of the play in all games. Ray Sirrs proved a most energetic and capable manager. The following men played in two or more games:

Bell, A. A.; Berner, T.; Brules, A.; Dowe, J. A.; Fitzgerald, A. M.; Fitzgerald, W. W.; Henderson, G. G.; Jennings, W. B.; McQueen, M. V.; Mutch, G. C.; Norman, R. M.; Williamson, J. A.

Junior School, after a hard fight, succumbed to St. Mikes in their group. However some good material was discovered for next year's campaign. Of the men who played in two games, seven were from the first year:

Agnew, R. J.; Bentley, W. A.; Burbank, E. F.; Burns, W. G.; Dickenson, F. R.; Leitch, K.; Little, E. M.; Lloyd, W. G.; Norman, H.; Peoren, J. E.; Teagle, R.; Smith, H.

We feel confident that next year will see School with a toe-hold and half-nelson on that old cup.

J. A. WILLIAMSON, Secretary.

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# U. OF T. RIFLE ASSOCIATION

At the school night in Hart House this winter, a fourth year man was heard to remark that it was the first time he had known that Hart House boasted a rifle range. So perhaps a few words about the University of Toronto Rifle Association would be in place.

The Association was reorganized in 1919, and is now in its third post-war year. Previous to the war it was quite a flourishing association and School won the DeLury Shield, emblematic of the Interfaculty championship, the three years preceding the war. The total membership is now 120 and of that number School has 25. Dents lead in the matter of membership with U. C. of "Spark Plug" fame, third.

During the fall term, shooting was held daily at the Long Branch ranges and on November 11, the annual Interfaculty and Intercollegiate match took place. Dents won the DeLury shield again this year and Manitoba nosed out first in the Intercollegiate, with Varsity second.

In the winter term, practice was held four times weekly on the indoor range. There were three Intercollegiate matches. The complete scores for the third are not in from the other universities competing, but Varsity leads and the splendid score made at the last shoot make their chances look bright.

In a shoot between three picked teams of the C. O. T. C. and the Rifle Association, all three teams of the latter won.

J. D. Walks.

## SQUASH

School's attitude toward squash has developed in much the same manner as the attitude toward spats. Both were at first regarded with suspicion as things outré and primarily designed for U. C. Then came tolerance, with some bolder spirits actually adopting the novelty. Now both are commonplace and going strong.

This year has seen a great increase in the number of Schoolmen playing squash. Perhaps fifty are actively interested in the game, the majority being in the senior years. Twenty per cent. of one of the larger departments in the graduating year play the game. So well has the University as a whole taken to squash that a court reservation for five o'clock is now precious beyond price.

School now holds second place on the permanent challenge board in the person of Steve Greey. Others listed are S. C. Scadding, E. W. Christman and V. D. Strickland.

In spite of the fact that the only hours free to Schoolmen are the most crowded hours at the squash courts, the game bids fair to increase in popularity. Inter-year or inter-departmental tournaments might well be run.

V. N. Bruce.

## BILLIARDS

Well, fellows, it's not so good. Apparently the boys from the Red School House are losing their prowess as billiard players, or should we say, are not keeping up to the other fellow. Let's show them next year and bring back the championship that School has held for the past two years.

S.P.S. "T.'s."

TOP ROW:—M. Wolsey (Gym.); G. E. Lindsay (Swimming); C. M. Wells (Swimming); R. H. Keefler (Swimming).

CENTRE ROW:—W. H. Duffill (Basketball); C. H. Lucas (Soccer); W. I. Turner (Track); A. A. Bell (Track); J. C. Harston (Swimming).

BOTTOM ROW:—F. S. Seaborne (Boxing); R. C. Relyea (Boxing); G. W. Smart (Rowing); G. G. Duncan (Rugby); A. M. Fitzgerald (Swimming); H. E. Wingfield (Soccer); N. F. Johnston (Soccer); M. G. Evans (Soccer).

School had a numbers of men entered in the tournaments and some did exceptionally well for comers; H. E. Turner reaching the finals. Switzer, Mueller, Burbank, McKellop and a few others also did well but failed to lift the cup. W. T. A. Bell, last year's champion, fell down in the pinch. So much for this year.

Billiards are becoming more and more popular, so let us see two School men fight it out for the honours next year. Rumor has it that J. M. Dymond is taking special coaching in billiards, and is going to give them all a run. More power, Jack! Let's make it a big year and bring the silverware back.

As in previous years, School will be well represented on the Billiard Committee next year, Mueller, McKellop, Burbank and Bell, all holding down office.

W. T. A. Bell.

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# CHESS

In this, as in so many other games of a more athletic nature, School has been active during the past year.

The Chess Club is an all-university club, and consists of both graduate and under-graduate members.

The executive for the present and next year is as follows:

1922-23

Honorary President—Dr. Rudolf.
President—J. P. Dandy, IV, U. C.
Secretary-Treasurer—J. D. Burbank, III, S. P. S.
Team Captain—C. H. Meader.

1923-24

Honorary President—Dr. Rudolf.
President—J. D. Burbank, III, S. P. S.
Secretary Treasurer—W. W. H. Coulter, II, S. P. S.
Team Captain—C. H. Meader.

In addition there are representatives for the various faculties. The representative for School was Mr. E. Cowan, 2T3. The 1923-24 executive was elected at the annual meeting, March 21, 1923, and will not take office until the first meeting in the Fall. The School representative for next year has not yet been appointed. However, School is fairly well represented on the executive, considering that Mr. Meader, the team captain, is an old School grad.

As regards the membership of the Chess Club, over half of the undergraduate members are School men. There is something about the game, which is purely one of calculation, that appeals to the mind of a School man who has such constant use for mathematics. This is one field in which, during the past year, our friends in the Medical have offered us

no competition. Besides the regular members of the club, there are a considerable number of School men who frequent the chess room with the idea of playing chess.

The club challenged the Toronto Chess Club to a series of three matches to decide the possession of the Shenstone trophy, emblematic of the chess championship of Toronto, and, I believe, Ontario as well.

Varsity lost the first game, playing eight boards, 2 1-2 games to 5 1-2, won the second, 5 to 3, and lost the third, 3 1-2 to 4 1-2. The last match was very close; one of our players had a won game, but owing to a little careless play lost it and thus losing the match, series and shield.

School is always well represented on the various teams. This year of the four medals presented to those players in their graduating year who had played on any team for two years or more, three went to School men. They were respectively: C. E. Lewis, B. Shaffer and E. Cowan. G. I. Wilkinson, also in his graduating year, although he made a good showing, was not eligible, as he had only played for one season.

E. Cowan was runner-up for the University championship in 1920. B. Shaffer won the Championship in 1921. C. E. Lewis was runner-up in 1922 and has a good chance to win this year.

The School members last year issued a challenge to any faculty or the University as a unit, to form a team of six players to beat them. The challenge was published in Varsity and a match was played. The all-university team used graduate players and yet School using under graduate players entirely, won easily.

J. D. BURBANK.

## BALANCE SHEET
of
## THE UNIVERSITY OF TORONTO, ENGINEERING SOCIETY
**As of March 9th, 1923.**

### ASSETS

| | | | |
|---|---|---|---|
| CURRENT | | | $7,274.96 |
| Cash | | $ 60.80 | |
| Bank (Current) | | 1,113.63 | |
| Bank (Savings) | | 1,002.63 | |
| Victory Bonds | | 2,000.00 | |
| Accounts Receivable | $412.45 | | |
| Less Reserve for Bad Debts | 281.65 | 130.80 | |
| Mdse. Inventory | | 2,967.10 | |
| | | $7,274.96 | |
| FIXED | | | 574.29 |
| Office Equipment | $624.29 | | |
| Less Reserve for Depreciation | 80.00 | $544.29 | |
| Smoking Room Furniture | 70.00 | | |
| Less Reserve for Depreciation | 40.00 | 30.00 | |
| | | $574.29 | |
| | | | $7,849.25 |

## UNIVERSITY OF TORONTO, ENGINEERING SOCIETY
### LIABILITIES
**As of March 9th, 1923**

| | | | |
|---|---|---|---|
| CURRENT | | | $2,653.01 |
| Accounts Payable | | $2,653.01 | |
| | | $2,653.01 | |
| LIABILITY TO ENGINEERING SOCIETY | | | 5,196.24 |
| Capital Accounts | | $5,190.72 | |
| By Unclaimed Dividends from 1922 | | 16.00 | |
| | | $5,206.72 | |
| Less Net Loss | | 10.48 | |
| | | $5,196.24 | |
| | | | $7,849.25 |

## UNIVERSITY OF TORONTO, ENGINEERING SOCIETY
### TRADING ACCOUNT
**From April 1st, 1922—March 9th, 1923**

| | | | |
|---|---|---|---|
| Sales | | | $13,889.45 |
| Mdse. Inventory, April 1st, 1922 | | $ 2,600.00 | |
| Mdse. Purchases | | 13,265.06 | |
| | | 15,865.06 | |
| Less Inventory, March 9th, 1928 | | 2,967.10 | |
| Mdse. Sold | | 12,897.96 | |
| Gross Profit to Profit & Loss Account | | 991.49 | |
| | | $13,889.45 | $13,889.45 |

## PROFIT & LOSS ACCOUNT

**From April 1st, 1922—March 9th, 1923**

| | |
|---|---|
| Salaries | $ 580.00 |
| Publications | 563.09 |
| General Expense | 864.54 |
| Alumni | 29.40 |
| Dance | 56.11 |
| Dinner | 67.05 |
| Orchestra | 43.00 |
| Grants to Clubs | 187.25 |
| Weekly Dance | 48.49 |
| Community Night | 179.75 |
| | $2,618.68 |
| By Gross Profit from Trading Account | $ 991.49 |
| " Fees | 1,494.00 |
| " Interest and Discount | 122.71 |
| | 2,608.20 |
| Net Loss | 10.48 |
| | $2,618.68 |

*Forsan et haec olim*
*meminisse juvabit*